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ANIMAL AND PLANT HEALTH INSPECTION SERVICE
WILDLIFE SERVICES

APHIS
Animal and Plant Health Inspection Service

IN COOPERATION WITH

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT

ORAL VACCINATION TO CONTROL SPECIFIC RABIES VIRUS VARIANT IN RACCOONS ON NATIONAL FOREST SYSTEM LANDS IN THE UNITED STATES

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EXECUTIVE SUMMARY

This supplemental Environmental Assessment (EA) documents the analysis of the potential environmental effects of a proposal to continue and expand the involvement of the U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service, Wildlife Services (APHIS-WS) program in oral rabies vaccination (ORV) programs to portions of National Forest System lands, excluding Wilderness Areas, in a number of states. The National Forest System lands (see Appendix H for a list of National Forests) where APHIS-WS involvement would be continued may be located within the states of Maine, New York, Vermont, New Hampshire, Pennsylvania, Ohio, Virginia, West Virginia, Tennessee, Kentucky, Alabama, Georgia, Florida, North Carolina, South Carolina, Massachusetts, Maryland, and New Jersey (See USDA 2004a). The National Forest System lands where APHIS-WS involvement would be expanded may be located within the states of Connecticut, Rhode Island, Delaware, Indiana, Michigan, Mississippi, and Louisiana. Currently, cooperative rabies surveillance activities and/or baiting programs are being conducted on various land classes, including many National Forest System lands, in many of the aforementioned states. The programs' primary goals are to stop the spread of a specific raccoon rabies variant or "strain" of the rabies virus. If not stopped, this strain could potentially spread to much broader areas of the U.S. and Canada and cause substantial increases in public and domestic animal health costs because of increased rabies exposures. Numerous National Forest System lands are located within current and potential ORV barrier zones. To effectively combat this strain of the rabies virus, it has become increasingly important to bait these large land masses.

The oral rabies vaccine used in these programs is the recombinant vaccinia-rabies glycoprotein (RABORAL V-RG® MERIAL, Inc.) vaccine currently licensed for use in raccoons and coyotes in the U.S. and Canada (although it is only being used for raccoons in Canada, as canine rabies has not been found in coyotes in Canada) and approved for experimental use in gray foxes in Texas. It has been used extensively and successfully in Europe to combat fox rabies. This vaccine is contained in baits which are distributed by aircraft and by ground placement and then are picked up and consumed by the target species. It has been found to be safe for use in a number of animal species.

The proposed action would involve use of federal funds by APHIS-WS to purchase ORV baits and cooperate with programs in the above states in the distribution of such baits over National Forest System lands to create zones of vaccinated target species that then serve as barriers to further advancement of this particular rabies virus variant. ORV baits could also be used in other areas where the raccoon rabies virus variant is known to occur with the goal of eliminating those variants from such areas. The proposed action would also include APHIS-WS assistance in monitoring and surveillance activities involving the capture and release or lethal collection of the targeted animal species in the above states to take biological samples for testing to determine the effectiveness of the ORV programs. APHIS-WS could also assist the states in implementing contingency plans that include the localized population reduction of the target species in areas where rabies outbreaks occur beyond ORV barriers. The role of the USDA-Forest Service (USFS) would involve cooperation with APHIS-WS in permitting access to National Forest System lands for bait disbursal and rabies monitoring and surveillance activities.

This supplemental EA analyzes a number of environmental issues or concerns with the oral rabies vaccine and with activities associated with ORV programs such as capturing and handling of animals for monitoring and surveillance purposes, as well as the potential implementation of contingency actions to address rabies outbreaks such as more concentrated localized ORV use or localized suppression of target species populations. The supplemental EA also analyzes several alternatives to the proposed action, including no action (i.e., no federal funding or participation by APHIS-WS on National Forest System lands), live-capture-vaccinate-release programs (trapping animals followed by administration of injectable vaccines and then release), and ORV bait distribution without animal specimen collections or localized lethal removal of target species under state contingency plans (i.e., no capturing or lethal removal of animals by APHIS-WS for monitoring or surveillance purposes or to address localized rabies outbreaks).

No cumulative impacts are anticipated from the distribution of ORV into the environment. The ORV vaccine and bait that would be used has been found safe to use on target and other animal species, has a negligible risk of causing adverse affects to humans, is readily consumed by target animal species, and does not cause bioaccumulation in the environment. A limited number of baits would be distributed one time per year, thereby limiting the potential for persons to be exposed to ORV baits or bait distributing equipment. Therefore, the analysis in this supplemental EA indicates no significant impacts on the quality of the human environment are expected from APHIS-WS continued or expanded involvement in these programs.

1.0 CHAPTER 1: PURPOSE OF AND NEED FOR ACTION

1.1 BACKGROUND

Rabies is an acute, fatal viral disease of mammals most often transmitted through the bite of a rabid animal. The earliest records suggest rabies was present in dogs about 2300 B.C., but the disease probably evolved before recorded history. Despite its long coexistence with humans, rabies is a public and animal health problem that annually results in 50,000 to 70,000 deaths a year worldwide. Up until 1960, most cases of rabies in the United States were reported in dogs. However, the combination of public education and vaccination programs for companion dogs has controlled rabies in dogs. The disease can be effectively prevented in humans and many domestic animal species; however, abundant and widely distributed reservoirs among wild mammals complicate rabies control. Within most of the U.S., these reservoirs occur in geographically discrete regions where the virus transmission is primarily between members of the same species (Krebs et al. 2000). These species include, but are not limited to, raccoons (*Procyon lotor*), coyotes (*Canis latrans*), skunks (primarily *Mephitis mephitis*), gray foxes (*Urocyon cinereoargenteus*), and red foxes (*Vulpes vulpes*). Species specific variants of the virus may be transmitted to other animal species; however these encounters rarely result in sustained virus transmission. Once established, virus transmission within a specific animal species can persist at epidemic levels for decades, even perhaps for centuries (Krebs et al. 2000).

The vast majority of rabies cases reported to the Centers for Disease Control and Prevention (CDC) each year occur in raccoons, skunks, and bats (Order *Chiroptera*). Red foxes account for less than 10 percent of the reported rabies cases, with domestic cats, dogs and cattle among those most often reported (CDC 2001a). Two canine rabies epidemics emerged in Texas in 1988, one involving coyotes and dogs in South Texas and the other in gray foxes in West/Central Texas. The South Texas epidemic alone has resulted in two human deaths and caused over 3,000 people to receive postexposure rabies treatment (TDH 2004).

1.1.1 Public Health Importance of Rabies

Over the last 100 years, rabies in the United States has changed dramatically. About 90 percent or greater of all animal cases reported annually to CDC now occur in wildlife (Krebs et al. 2000, CDC 2001a). Before 1960 the majority of cases were reported in domestic animals. The principal rabies hosts today are wild carnivores and bats. The number of rabies-related human deaths in the U.S. has declined from more than 100 annually at the turn of the century to an average of one or two people/year in the 1990s. Modern day prophylaxis, which is the series of vaccine injections given to people who have been potentially or actually exposed, has proven nearly 100 percent successful in preventing mortality when administered promptly (CDC 2001a). In the U.S., human fatalities associated with rabies occur in people who fail to seek timely medical assistance, usually because they were unaware of their exposure to rabies.

Although human rabies deaths are rare, the estimated public health costs associated with disease detection, prevention, and control have risen, and are estimated to exceed $300 to $450 million annually. These costs include the vaccination of companion animals, maintenance of rabies laboratories, medical costs, such as those incurred for exposure case investigations, rabies post-exposure prophylaxis (PEP) and animal control programs (CDC 2001a). In addition, each year tens of thousands of people are impacted by anxiety, fear, and trauma associated with potential or actual rabies exposure to themselves and their domestic animals. Exclusion, proper storage and disposal of garbage, and removal of problem animals are often effective alternatives to address wildlife rabies threats at specific sites; however, oral rabies vaccination (ORV) is the only currently available technique that shows promise for wildlife rabies control on a broad geographic and species scale (Slate et al. 2002).

Accurate estimates of these expenditures are not available. Although the number of PEPs given in the U.S. each year is unknown, it is estimated to be about 40,000. When rabies becomes epizootic or enzootic (i.e., present in an area over time but with a low case frequency) in a region, the number of PEPs in that area increases. Although the cost varies, a course of rabies immune globulin and five doses of vaccine given over a 4-week period typically exceeds $1,000 (CDC 2001a) and has been reported to be as high as $3,000 or more (Meltzer 1996). In Massachusetts during 1991-1995, the median cost for PEP was $2,376 per person (CDC 2001b).

Also, as epizootics spread in wildlife populations, the risk of "mass" human exposures requiring treatment of large numbers of people that contact individual rabid domestic animals infected by wild rabid animals increases – one case in Massachusetts involving contact with, or drinking milk from, a single rabid cow required PEPs for a total of 71 persons (CDC 2001b). The total cost of this single incident exceeded $160,000 based on the median cost for PEPs in that state cited above. Perhaps the most expensive single mass exposure case on record in the U.S. occurred in 1994 when a kitten from a pet store in Concord, NH tested positive for rabies after a brief illness. As a result of potential exposure to this kitten or to other potentially rabid animals in the store, at least 665 persons received postexposure rabies vaccinations at a total cost of more than $1.1 million (Noah et al. 1995).

1.1.2 Raccoon Rabies in the Eastern U.S

Epizootic rabies among raccoons in the U.S. was first identified in Florida in the 1940s and, therefore, is considered an exotic strain in the U.S. outside this area (C. Rupprecht, CDC, pers. comm. 2003). The affected area gradually expanded into other southeastern states. In the late 1970s, a second focus of rabies among raccoons emerged on the West Virginia/Virginia border (Childs et al. 2000, Krebs et al. 2002). Raccoon rabies was first introduced to the mid-Atlantic region of the U.S. with the translocation of infected raccoons from Florida to Hardy County, WV and Shenandoah County, VA in 1978 and 1979 (Nettles et al. 1979). From these counties, the disease spread rapidly along the east coast and has now become enzootic[1] in all of the east coast states as well as Alabama, Pennsylvania, Vermont, West Virginia, and eastern Ohio (Krebs et al. 2000).

Epizootiologic and virologic investigations indicated this new focus in the mid-Atlantic region resulted from the translocation of raccoons incubating rabies from the southeastern U.S. The epizootic front of the mid-Atlantic outbreak has progressed in a primarily northeasterly direction at a rate of 30-47 km/yr (18.6-24.9 mi/yr). The northern extension of this epizootic reached Canada in 1999 with its first three cases of raccoon rabies confirmed in southern Ontario (Rosatte et al. 2001) and the strain has recently been reported in New Brunswick. To the south, the once separate epizootics of raccoon rabies in the mid-Atlantic and southeastern states converged in North Carolina in 1994 (Childs et al. 2000, Krebs et al. 2002). The epizootic of rabies involving raccoons that developed in the mid-Atlantic region is one of the largest documented outbreaks in the history of wildlife rabies. More than 50,000 cases of rabies among raccoons in eastern states have been reported to the CDC since 1980 (Childs et al. 2000). In most southeastern and mid-Atlantic states, raccoons account for the largest proportion of laboratory-confirmed rabid animals (Woodruff and Jones 1991). Most human exposures from rabid raccoons and other wild animals involve animals encountered in the wild. In addition, exposures to rabid wild animals kept as pets have also been documented (Woodruff and Jones 1991).

The 1983 arrival of the mid-Atlantic rabies epizootic in raccoons in Washington, D.C. raised interest in raccoon and disease ecology in urban areas, particularly because of the high densities of both humans and raccoons and the increased possibility of transmission of disease from raccoons to humans or domestic animals (Riley et al. 1998). For instance, raccoon density in Rock Creek National Park in Washington, D.C. was from twice to more than 100 times (333.3 to 66.7 raccoons per sq km) that reported for the species in non-urban habitats and was consistent with the few estimates published for other urban and suburban raccoon populations (Riley et al. 1998). Researchers in urban and suburban areas have found that dense populations of raccoons are more likely to be subject to epizootics of contact diseases such as rabies and canine distemper and may be more likely to continue to harbor a disease after the initial epizootic (Riley et al. 1998). Dense raccoon populations in close proximity to high-density human populations may represent a public health threat as reservoirs of parasites and diseases. For these reasons, management of urban and suburban raccoon populations often is warranted (Prange et al. 2003).

The number of reported cases of rabies among wild and domestic animals increases in summer when people, especially children, are outdoors more often and are, therefore, more likely to come into contact with a rabid animal (Beck 1984). In the U.S., dog-to-dog rabies transmission is rare. Most cases of rabies in dogs and other domestic animals have been reported from areas where rabies is found among wildlife, particularly foxes,

[1] A disease present among animals in a particular region or locality.

skunks, and raccoons (Beck 1984). In the mid-Atlantic outbreak, nine domestic animals had been exposed to 247 rabid raccoons, documenting the importance of the present raccoon problem. Raccoons are a greater threat to dogs and, therefore, people, than skunks, foxes, or bats, even though there are more cases nationwide of rabies among the latter three (Beck 1984). Raccoons are a threat because they thrive in urban and suburban areas, can make use of human habitats, and are considered by many people to be more "tolerable" than skunks and foxes (Beck 1984). In fact, the CDC reported that raccoons accounted for almost 40 percent of the 7,437 cases of rabies that were reported in the U.S. in 2001 (CDC website: http://www.cdc.gov).

The director of the CDC has indicated that raccoon rabies presents a serious public health problem in the U.S. (letter to APHIS-WS, dated May 29, 2001). Potential direct exposure to rabid raccoons, or indirect exposure by a pet that had an encounter with a rabid raccoon, creates this human health threat. To date, one case resulting in the death of a human is attributable to the raccoon strain of the rabies virus. A 25-year-old, previously healthy northern Virginia man died in June 2003. A diagnosis of rabies had not been considered and was only made 3 months after death when brain tissue was examined. Patient history did not reveal contact with animals and no specific exposure experience could be determined (S. Jenkins, Virginia Department of Health, pers. comm. 2003; L. Orciari, CDC, pers. comm. 2003). Raccoon rabies also increases health care costs. The number of pets and livestock examined and vaccinated for rabies, the number of diagnostic tests requested, and the number of post exposure treatments are all greater when raccoon rabies is present in an area. Human and financial resources allocated to rabies-related human and animal health needs therefore increase, often at the expense of other important activities and services.

The westward and northward movement of the raccoon rabies front has slowed, probably in response to both natural geographic and man-made barriers. The Appalachian Mountains and perhaps river systems flowing eastward have helped confine the raccoon variant to the eastern U.S. In addition, the rabies management program has established ORV zones from the Pennsylvania/Ohio border (between Lake Erie and the Ohio River) to the Gulf of Mexico that has drastically slowed the westward expansion of raccoon rabies. If raccoon rabies breaches this zone, current live trapping results in Ohio (A. Montoney, APHIS-WS, pers. comm. cited in Kemere et al. 2001) and other states, as well as the status of raccoons in the Midwest (Sanderson and Hubert 1982, Glueck et al. 1988, Hasbrouck et al. 1992, Mosillo et al. 1999), suggest that raccoon populations are sufficient for rabies to spread westward along a front at a rate similar to or greater (Rupprecht and Smith 1994) than the rate at which this rabies strain has spread in the eastern U.S. Figure 1-1 shows the potential for spread of this rabies variant across the central portion of the U.S. if it is not stopped.

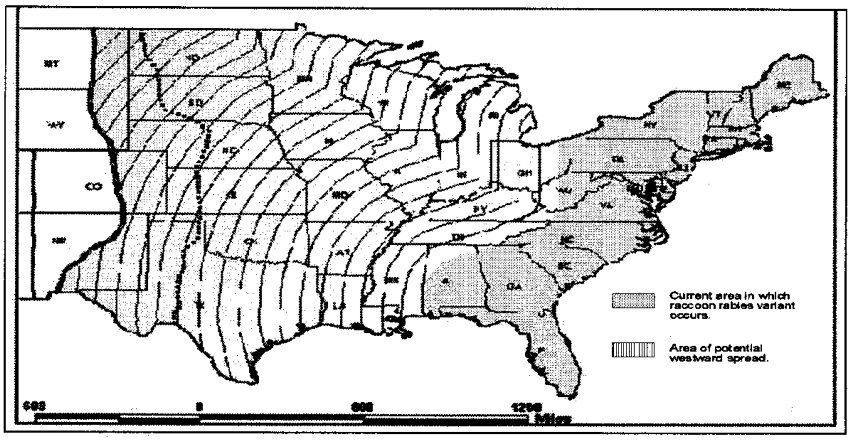

Figure 1-1. Potential areas of the U.S. into which raccoon rabies could spread if not stopped by rabies management programs. From Kemere et al. (2001).

1.1.3 Primary Need for Action.

People are concerned with potential health threats and costs associated with being exposed to a rabid animal. People are most often exposed through a bite from a wild or domestic animal infected with the disease (CDC

2001a). More than 90 percent of all reported animal cases occur in wild animals (CDC 2001a). Rabies is a fatal disease in humans unless medically treated with postexposure prophylaxis. Human health care concerns associated with the disease would be expected to increase as the rabies virus infects a much broader geographic area. Continuation and expansion of ORV activities to include National Forest System lands is important for providing adequate coverage to the ORV zones and other outbreak areas in order to retain program effectiveness.

In the area that stretches west from the leading edge of the current distribution of raccoon rabies (which stretches from Alabama northeastward along the Appalachian Mountains through coastal Maine) to the Rocky Mountains, there are more than 111 million livestock animals, including cattle, horses, mules, swine, goats, and sheep, valued at $42 billion (65 FR 76606-76607, December 7, 2000). Also within this area are countless numbers of domestic animals that are kept by people as pets (cats, dogs, rabbits, ferrets, etc). If raccoon rabies were to spread into the above described area, many of these domestic animals would be at risk of being exposed to this specific variant.

1.1.4 Development of Oral Rabies Vaccination Programs.

Although the concept of ORV to control rabies in free ranging wildlife populations originated in the U.S. (Baer 1988), it has a longer history of implementation in Europe and Canada. The implementation of ORV programs in several Western European countries using either attenuated rabies vaccines or the recombinant Raboral V-RG® have resulted in several European countries being designated free of rabies (Slate et al. 2002). In North America, the Province of Ontario, Canada expanded research during the mid-1970s to evaluate the prospect of using ORV to eliminate rabies that became established in red foxes in the southern part of the Province during the 1950s. Since 1989, the Ontario Ministry of Natural Resources has aerially distributed about 12 million baits containing an attenuated rabies virus (ERA vaccine) that has reduced rabies in foxes by more than 97 percent (Slate et al. 2002).

The emergence of raccoon rabies in the U.S. during the 1970s heightened interest in the application of ORV to raccoons. Due to biological and ecological differences among the types of animals that transmit rabies, development of specific vaccine and bait combinations was needed. One of the main difficulties was the development of a safe and effective vaccine for raccoons. In contrast to red foxes, which were the primary subjects of ORV programs in Europe and Canada, raccoons were not readily immunized by the oral route with the modified "live virus" vaccines that worked well in foxes (Rupprecht et al. 1988). Furthermore, modified "live virus" vaccines pose a small risk of causing vaccine-induced rabies, and have resulted in some cases of vaccine-induced rabies in animals (but no cases in humans) during oral baiting programs in Europe and Canada (Wandeler 1991).

As a consequence of field safety testing in the early 1990's, a vaccinia-rabies glycoprotein (V-RG) vaccine was conditionally U.S. Department of Agriculture (USDA)-licensed for vaccination of free-ranging raccoons in 1995 and fully licensed in 1997 in the U.S. (Hanlon et al. 1999). It remains the only effective vaccine licensed for use in the U.S. and Canada for raccoons (CDC 2000). V-RG was also recently licensed by the USDA in 2002 for vaccination of coyotes in the U.S. and Canada (although it is only being used for raccoons in Canada, as canine rabies has not been found in coyotes in Canada). It has also been approved for experimental use by USDA, Animal and Plant Health Inspection Service (APHIS), Veterinary Services (VS), Center of Veterinary Biologics for vaccination of free-ranging wild gray foxes in Texas (CDC 2001a, Hanlon et al. 1999).

The V-RG vaccine has proven to be orally effective in raccoons, coyotes and foxes (USDA 2004a, Oertli et al. 2002). This vaccine was extensively laboratory-tested for safety in more than 50 animal species with no adverse effects regardless of route or dose (Rupprecht et al. 1992a). In addition, a domestic animal's annual rabies vaccination can be safely administered even if it recently ingested a dose of oral rabies vaccine (Oertli et al. 2002).

The vaccinia-rabies glycoprotein vaccine used by the ORV program is commercially available from MERIAL, 115 Transtech Drive, Athens, GA 30601 under the registered name RABORAL V-RG®. Throughout the remainder of this document, RABORAL V-RG® is referred to as "V-RG". As a recombinant vaccine, the letter "V" is used to denote vaccinia, the self-replicating pox virus that serves as the vector (i.e., carrier) for the rabies virus gene that is responsible for the production of rabies glycoprotein. The letters "RG" stand for rabies glycoprotein which is the protective sheath around the bullet-shaped rabies virus core. The glycoprotein by itself is non-infective and cannot cause rabies, but it serves as an "antigen" which means it elicits an immune response to rabies when the vaccine is swallowed by raccoons, foxes, or coyotes. There is no possibility of vaccine-induced rabies with V-RG because the vaccine only contains the non-infective surface protein of the rabies virus; none of the viral nuclear material (i.e., RNA) which would be required for the rabies virus to replicate is present in the vaccine. Approximately 55.3 million doses have been distributed in the U.S. since 1995 with only one case of vaccinia virus infection reported in humans (resulting in localized skin rashes) to date (Rupprecht et al. *unpublished* 2001, Rupprecht et al. 2001).

A number of studies have been conducted to determine the best bait formulations and strategies for delivery of ORV vaccines to raccoons (Hanlon et al. 1989a, Hable et al. 1992, Hadidian et al. 1989, Linhart et al. 1991, Linhart et al. 1994). When raccoons eat oral rabies baits and puncture a sachet[2] containing the vaccine, the vaccine is swallowed and bathes the lymphatic tissue in the throat area and initiates the immunization process.

A positive rabies antibody titer in an animal from a baited area is most likely due to consumption of a bait and adequate contact with vaccine. However, the lack of a detectable antibody response may not be an accurate reflection of immune status. It is possible that the animal was successfully immunized, but that the blood sample was taken earlier or later than when antibodies could be detected (C. Hanlon, CDC, pers. comm. 2003). Antibodies induced by a one-time oral vaccination appear to be of relatively short duration. Among a group of animals in a baited area, the best time to collect blood samples for detection of antibodies is 4-8 weeks after baiting. A successfully immunized animal may have antibodies shortly after vaccination, but then the level may decline to undetectable levels. If the animal is then exposed to rabies, it is still likely that the animal's "memory" immunity will become activated by the rabies exposure and more antibodies will be made very quickly. The successfully immunized animal will most likely survive exposure, even though it did not have measurable antibodies at the time of the exposure (C. Hanlon, CDC, pers. comm. 2003).

The baits are small blocks of fishmeal, weighing approximately 26 grams and measuring 11/4 x 11/4 x 3/4 inches, that are held together with a polymer binding agent and are considered to be "food grade" materials (Figure 1-2). The baits are rectangular or square in shape with hollow centers. The sachet containing the liquid vaccine is contained in the hollow center of the bait. The sachet is composed of a thin plastic material that is not readily digested by the animal ingesting the bait and is subsequently passed through the animal's digestive tract. "Coated" sachets with a simple fishmeal attractant coating have also been field tested with effectiveness that appears to be comparable to fishmeal polymer baits containing the sachet (Linhart et al. 2002). Using the "coated" sachet may be equal in effectiveness at lower cost per vaccinated target wild animal. All baits are marked with a warning label that includes a phone number to call for additional information.

Cornell University recently conducted a study (USDA 2005a) comparing the performance of the coated sachet to fishmeal polymer baits for delivering oral rabies vaccine in the wild. Results from this study, along with those from captive studies being conducted by the APHIS-Wildlife Service (WS), National Wildlife Research Center, are critical to decisions regarding the best available bait for delivering oral rabies vaccine to raccoons. Preliminary results, yet to be published by Cornell, suggest that the coated sachet performs at least as good as fishmeal polymer bait and often exceeds its performance. Generally higher performance at a lower cost (approximately 20 percent less than fishmeal polymer baits), plus the lower risk of damage from aerial bait distribution, make the coated sachet a good interim bait option while other baits are evaluated for safety and efficacy.

[2] A thin plastic packet much like those in which condiments (e.g., catsup, mustard) are provided at fast food restaurants.

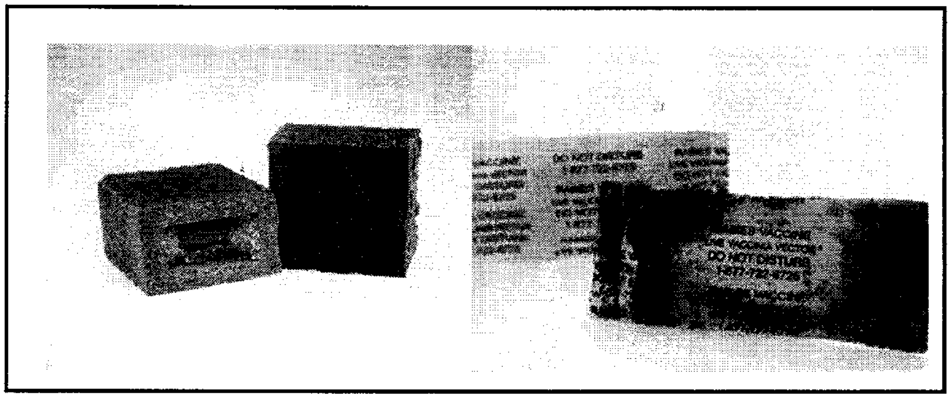

Figure 1-2. A (Left): Fishmeal polymer and B (Right): coated sachet baits utilized during the National ORV program. (Photos used with permission from MERIAL Limited, Athens, Georgia, USA).

Fishmeal polymer baits contain a tetracycline biomarker. These biomarkers bind to calcium, which can be found in the metabolically active portions of bones and teeth of animals. Tetracycline deposits can be viewed in the teeth or bones with fluorescent light under a microscope. When the tooth or bone sample of an animal is positive for tetracycline, it is likely that the animal has eaten at least one bait and possibly multiple baits (C. Hanlon, CDC, pers. comm. 2003). The presence of tetracycline, however, is not an indication of immunity since it is possible in some situations for an animal to eat the outer bait matrix without rupturing the vaccine sachet inside. Other potential sources of "background" tetracycline in a study area may include consumption of medicated feeds such as those sometimes used for production animals, intentional treatment by humans with tetracycline, and non-specific fluorescence from undescribed but similar chemical compounds that may be found naturally (C. Hanlon, CDC, pers. comm. 2003).

In field tests conducted in the U.S., the majority of ORV baits have been consumed within the first 7 to 14 days after placement, with reports of up to 100 percent of the baits being consumed within a 7 day period (Farry et al. 1998a and 1998b, Hable et al. 1992, Hadidian et al. 1989, Hanlon et al. 1989a, Linhart et al. 1994, Steelman et al. 2000, USDA 1995a). The likelihood of a bait being consumed is dependent upon several factors including animal population densities (target and nontarget species), bait preference, and the availability of alternative food sources. Those baits that are not consumed may remain in the environment for several months after placement, dependent upon environmental conditions (precipitation, temperature, etc.) and the condition of the baits. The V-RG virus that is not consumed by the target species or other vertebrates will become inactivated over a relatively short time period. Persistence and stability of the V-RG virus outside of an organism is highly dependent on ambient temperature and local environmental conditions, the higher the temperature the quicker the virus will become inactive (USDA 1992, 1995a). For example, at temperatures between 68 and 100 degrees Fahrenheit the liquid viral vaccine potency remains stable for approximately 14 to 7 days, respectively, in the un-punctured sachet or inside the bait. In situations where the bait and sachet are damaged inactivation of the V-RG virus will occur more rapidly.

Oral wildlife vaccination for rabies control has been under field evaluation in the U.S. since 1990. At that time a limited field release of the recombinant vaccine occurred on Parramore Island, VA to evaluate the potential effects that V-RG baits may have on free-ranging raccoon populations (Hanlon et al. 1998). As a result of this field trial and subsequent trials elsewhere, an effective V-RG has been developed to control species specific rabies variants to complement other methods of rabies prevention and control including public education, domestic animal vaccination, and human PEP. In 2004, APHIS-WS, in cooperation with the CDC, conducted small mammal vaccinia surveillance on Parramore Island, VA (results are pending). Because this is the site where vaccinia was first released into the wild in ORV baits and since these baits have not been released at this site since the early 1990s, viruses in hosts can be monitored. Microtine mammals, especially rodents, are typically the most likely hosts for orthopox viruses, which include vaccinia. Thus, these mammals are good sentinel species for indicators for the environmental presence of viruses, such as vaccinia. Samples will be collected and tested at CDC laboratories to determine the presence of vaccinia virus in small mammals collected at this site. Similar vaccinia surveillance (sampling and testing) of small mammals was also conducted in 2004 and 2005 at Plum Brook, OH (results are pending).

Figure 1-3. Current oral rabies vaccination barrier zones in the U.S.

Since the first field release of the V-RG vaccine in 1990, the number of vaccine-laden baits that were distributed annually in the U.S. has risen exponentially. For instance, APHIS-WS' involvement in the national rabies management program between 1995 and 2004 contributed to 55.3 million ORV baits disbursed in the U.S (USDA 2005b). Currently, the ORV program has barriers in place along the U.S./Canada border in the northeast and south from Lake Erie along the Appalachian ridge into Alabama (Figure 1-3) to combat the raccoon strain of the rabies virus. Numerous projects have been conducted or are in progress in eastern U.S. states lying within the current barrier areas. Programs are simultaneously conducted in Texas to combat the gray fox and coyote strains of the rabies virus (USDA 2005a, 2005b). Since ORV program inception, positive rabies cases have either decreased or the advance of the virus has been slowed or stopped in each state where an ORV program was initiated:

- *Maryland ORV Program*
  In Maryland, an average of 19 positive raccoon rabies cases were reported per year on the Annapolis Peninsula alone before the ORV program began in 1998. In 1998, after initiation of the ORV program, seven positive cases were reported. In 1999, one case was reported; from 2000-2002 zero cases were reported; in 2003, one case was reported; and in 2004, five positive raccoon strain rabies cases were reported. (USDA 2005a, 2005b).

- *New York ORV Program (Figure 1-4)*
  In New York, an ORV program was implemented in 1998 to prevent the northward spread of the virus from the St. Lawrence region into Canada. The bait zone is bounded by the St. Lawrence River to the North, Lake Ontario to the West, the Tug Hill Plateau to the South, and the Adirondack Mountains to the East. Since 1998, WS has cooperatively participated in the New York ORV Program. This project is part of a larger Northeastern ORV effort that includes: Vermont; New Hampshire; Maine; and the provinces of Ontario and New Brunswick, Canada. The Northeastern ORV Program is in turn, tied to a National ORV Program working to contain and eliminate the raccoon variant of the rabies virus. Prior to the ORV program in New York, approximately 150 positive rabies cases were recorded in 1998 and 1999. After initiation of the ORV program in this area, New York reported a decline to zero positive raccoon rabies cases. In 2004, two striped skunks tested positive with the raccoon strain of the rabies virus (USDA 2005a, 2005b). A recently completed project in Albany and Rensselaer Counties of New York State demonstrated that by use of ORV, raccoon rabies may be virtually eliminated from an area where the disease had been present for a number of years.

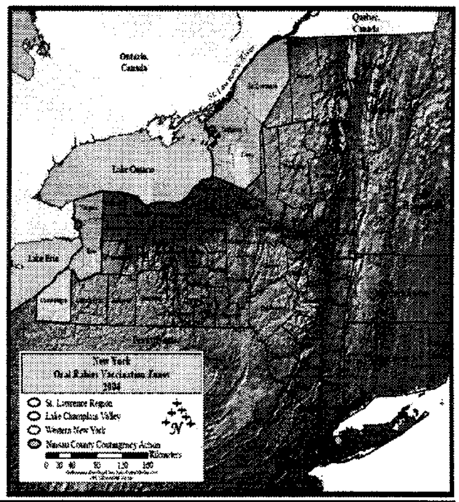

Figure 1-4. New York 2004 ORVAC zone.

  In late August, 2004, APHIS-WS initiated a cooperative emergency rabies surveillance and control program on Long Island (Nassau County) in cooperation with the New York State Department of Health (NYSDOH), Agriculture and Markets, Department of Environmental Conservation and the Nassau County Department of Health. The program included enhanced surveillance to better document the location and scope of a recent rabies outbreak and vaccination of raccoons to prevent the further spread of rabies. As a result of enhanced surveillance efforts, ten raccoons were confirmed to have the raccoon strain of rabies in Nassau County. More than 350 raccoons were trapped and submitted for testing within a 2 mile radius of the index case. This is the first time raccoon rabies has been documented on Long Island. Two types of vaccination programs were implemented in September, 2004 on Long Island by APHIS-WS and NYSDOH, including raccoon trap-vaccinate-release (more than 400 raccoons vaccinated) and ORVAC programs where 11,000 coated sachet baits were distributed by New York State police helicopters and 10,000 fishmeal polymer baits were distributed by hand in a 171 sq km (66 sq mi) zone around the positive cases. The contingency effort on Long Island focused on creating a rabies-immune raccoon population in the target zone to prevent additional cases. High densities of raccoons on Long Island make it more likely for a human, pet, or other domestic animal to encounter a rabid raccoon; thus the spread of raccoon rabies is of great concern. Enhanced surveillance and vaccination of raccoons will greatly decrease the chance of human and domestic animal contact with rabid raccoons (R. Chipman, APHIS-WS, pers. comm. 2004; USDA 2005a, 2005b).

- *Vermont ORV Program*
  The raccoon strain of the rabies virus first entered Vermont in 1994 and quickly spread to all 14 counties in the state. Before the Vermont portion of the program was initiated in 1997, positive rabies cases were found 73 km (45.5 mi) south of the Quebec, Canada border. With an annual rate of spread of rabies at 56.3 km/year (35 mi/yr), positive raccoon strain rabies cases should have reached the Quebec, Canada border as early as 1999. However, the border has not yet been breached, likely due to the expanding ORVAC zone in northern Vermont which now covers approximately 37 percent of the state. Annual vaccination projects in the Lake Champlain Valley in Vermont and New York have shown promise in preventing the northward spread of raccoon rabies (USDA 2005a, 2005b).

- *Ohio ORV Program (Figure 1-5)*
  In Ohio, 62 positive rabies cases were recorded prior to program implementation in 1997. In 1998, reported cases declined to 26. From 1999-2002, between zero and one case were reported in Ohio. In 2003, two cases were reported less than one mile west of the Pennsylvania border where raccoon rabies is still enzootic. The ability to create rabies-free zones, within raccoon rabies enzootic areas, is a requisite to achieve elimination of this variant of the rabies virus. Thus, an ORV program was implemented in Pennsylvania in 2001 to address this issue (USDA 2005a, 2005b).

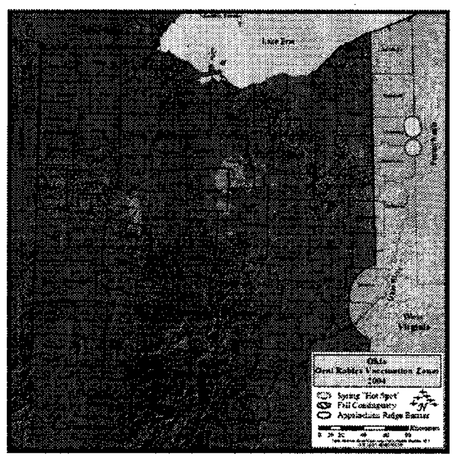

Figure 1-5. Ohio 2004 ORVAC zone.

During 2004, however, Ohio identified its first case of raccoon strain rabies in Lake County, located 10.6 km (6.6 mi) west of the existing ORV barrier. This outbreak was disconcerting as the Ohio barrier, up until this point, had been maintained and considered successful in nearly eliminating raccoon rabies from the state. The raccoon strain of the rabies virus quickly spread and cooperative surveillance efforts revealed 45 raccoons and one skunk positive for raccoon strain rabies within three counties (Geauga, Lake, and Cuyahoga) in Ohio. Prior to the 2004 ORV season, the Ohio program had prepared to move the existing 25-mile wide ORV barrier five miles east as the existing barrier had been maintained and considered successful in nearly eliminating raccoon strain rabies from the state. The only exceptions had been isolated cases of rabies occurring in "hot spots" less than one mile from the Ohio-Pennsylvania border. The western-most outbreak triggered a contingency action response, which encompassed a 2,471 sq km (954 sq mi) area in 2004. In response to the case of raccoon strain rabies discovered in the contingency area, a large scale trap-vaccinate-release program was implemented in addition to the distribution of 98,565 ORV baits. This breach does not represent a failure of the national rabies management program; rather it reinforces the need for enhanced surveillance and public education about the translocation of wildlife. The rabies cases west of the ORV barrier, as well as those in "hot spot" areas near the Ohio-Pennsylvania border, are still a reminder that the continuation of ORV, supported by enhanced surveillance is necessary. This will allow WS to contain, reduce, and potentially eliminate the raccoon strain of the rabies virus in Ohio and throughout the Eastern U.S (USDA 2005a, 2005b).

- *West Virginia ORV Program (Figure 1-6)*
  In 2001, West Virginia became involved in the National ORV Program, as a key state in establishing a national barrier to prevent the westward spread of raccoon rabies. By 2004, the ORV bait zone covered 25,842 sq km (9,978 sq mi). The West Virginia ORV program was undertaken as part of a nationwide, cooperative effort to stop the westward spread of raccoon (*Procyon lotor*) strain rabies. Raccoon strain rabies was first introduced into West Virginia in 1977, from raccoons translocated from the southern United States to Hardy County. The virus then spread along the leeward side of the Appalachian Mountains into Pennsylvania, Maryland, and Virginia until it breached the Appalachian Mountain front and began spreading in the cardinal directions through West Virginia.

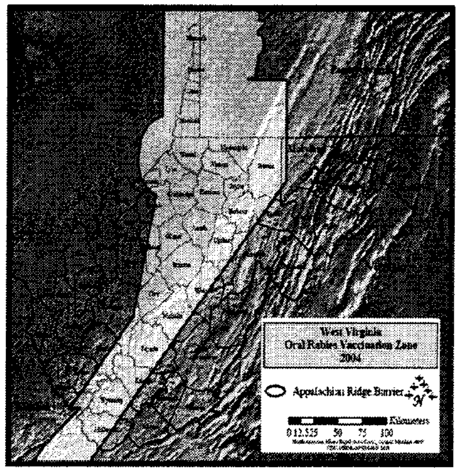

Figure 1-6. West Virginia 2004 ORVAC zone.

- *Massachusetts ORV Program (Figure 1-7)*
  In Massachusetts, the rabies virus had not spread to Cape Cod where intensive baiting programs at the peninsular neck (since 1995), combined with the natural barrier of Cape Cod Canal, seemed to act as effective barriers (Robbins et al. 1998). In early March 2004, however, raccoon variant of the rabies virus was confirmed east of the Cape Cod Canal for the first time. The canal served as the eastern anchor point for the ORV zone which was designed to prevent raccoon rabies from spreading east onto the Cape. This cooperative project was initiated in the mid-1990s by Tufts University and the State of Massachusetts Health Department. APHIS-WS became a partner in this effort in 2001. APHIS-WS, Tufts University, and the State of Massachusetts Health Department immediately implemented enhanced rabies surveillance, followed by trap-vaccinate-release, and ORV as a contingency action plan to prevent further spread, with the long range goal of eliminating raccoon rabies from the area. It is not known if raccoon rabies spread to the Cape through the long range movement of an individual rabid raccoon, or skunk infected with raccoon variant of the rabies virus, or if the virus spread animal to animal approaching the canal, with rabies spreading to the Cape through a short range raccoon or skunk movement across the canal. Translocation, either intentional or unintentional (i.e., raccoon "hitch-hiking" in a garbage truck or tailored boat and escaping once on the Cape), represents another other potential source of spread (USDA 2005a, 2005b).

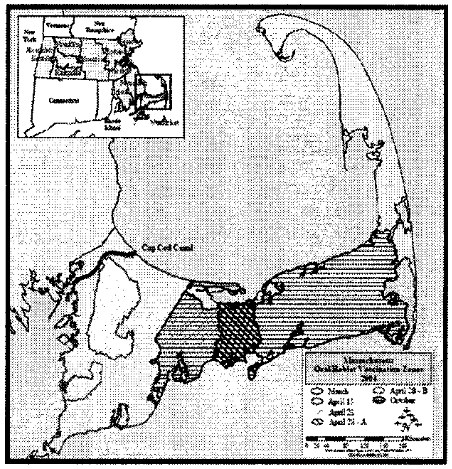

Figure 1-7. Massachusetts 2004 ORVAC zone.

- *Tennessee ORV Program*
  In June 2003, the rabies front, which had stalled in North Carolina, finally moved west and crossed over the Appalachians into east Tennessee (4 positive raccoon strain cases were reported). In January 2004, the rabies front, approaching from northern Georgia, crossed over into southeastern Tennessee (14 positive raccoon strain cases were documented). In attempt to stay ahead of the rabies front, the ORV program was conducted in two different areas in eastern Tennessee during 2004 (USDA 2005a, 2005b).

- *Texas ORV Program (Figure 1-8)*
  Since 1995, 22.6 million vaccine-laden baits have been distributed in Texas in an ORV program that has proved to be highly effective in the elimination of the coyote rabies strain and the dramatic reduction of the gray fox rabies strain. Prior to the ORV program (in 1994), 122 canine strain rabies cases were reported in Texas. Since program implementation in 1995, one case was reported in 2001 along the Texas-Mexico

border with zero cases reported until 2004. During 2004, a single canine rabies case involving a stray dog was confirmed in Laredo, Texas. This isolated case occurred within 1.61 km (1 mi) of the U.S.-Mexico border. In response, the City of Laredo Health Department's Animal Control Division implemented an aggressive isolation and vaccination protocol. Additional control measures included the increased vaccination clinics for domestic pets throughout the city. No additional rabies cases have since been reported (USDA 2005a, 2005b).

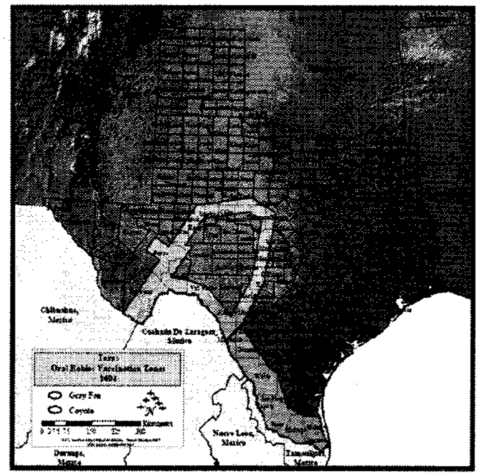

Figure 1-8. Texas 2004 ORVAC zone.

Similar success is sought in the gray fox epizootic in west-central Texas. In 2002, 18 positive cases of gray fox strain rabies occurred outside the barrier, likely due to an interrupted baiting program in 2000 and 2001 as a result of a lack of funding. Increased funding was provided for the 2003 gray fox ORV program in Texas in order to encircle the zone where positive cases have been reported and to blanket the area. In 2003, only 6.6 percent of positive gray fox strain cases were found outside the ORV zone (the rest being found inside the encircled area). In 2004, zero positive cases were reported outside the ORV zone (USDA 2005a, 2005b).

- Other ORVAC Programs
  Projects have also been conducted or are in progress in New Jersey (2003-present), Florida (1995-present), Virginia (2000-present), West Virginia (2001-present), Pennsylvania (1995-present), New Hampshire (2002-present), Alabama (2003-present), Georgia (2003-present), Maine (2003-present), Kentucky (2003-present), Louisiana (2003-present), North Carolina (2005), and Mississippi (2003-present).

The challenge for successful elimination of raccoon rabies in the U.S. involves cooperation by numerous states and land managers. Single states within the larger enzootic zones cannot proceed with elimination programs in isolation. Re-invasion from neighboring states will always be a risk unless all programs are coordinated carefully. In Germany, elimination of fox rabies has progressed slowly, at least partly because the individual states did not act in concert. In France, which had a national program, elimination occurred within 5 years. The challenge in North America concerning raccoon rabies is to achieve cooperation and coordination between two or more levels of government in two countries (MacInnes and LeBer 2000). The use of oral vaccination in Switzerland during the past 20 years resulted in a declaration of rabies-free status in 1998. A similar declaration was made by France at the end of 2000 (Krebs et al. 2002).

1.2 DESCRIPTION OF THE PROPOSED ACTION

The United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service-Wildlife Services (APHIS-WS), in cooperation with the USDA-Forest Service (USFS), proposes to continue and expand the ORV program to portions of National Forest System lands, excluding Wilderness Areas, in a number of states where raccoon rabies outbreaks occur or have the potential to occur. The National Forest System lands (see Appendix H for a list of National Forests) where APHIS-WS involvement would be continued may be located within the states of Maine, New York, Vermont, New Hampshire, Pennsylvania, Ohio, Virginia, West Virginia, Tennessee, Kentucky, Alabama, Georgia, Florida, North Carolina, South Carolina, Massachusetts, Maryland, and New Jersey (See USDA 2004a). The National Forest System lands where APHIS-WS involvement would be expanded may be located within the states of Connecticut, Rhode Island, Delaware, Indiana, Michigan, Mississippi, and Louisiana. Figure 1-9 shows the states and National Forest System lands where ORV activities could occur. Potential areas involved may cover several land types and land uses including: forests, meadows, wetlands, and rangelands, representing diverse wildlife habitats. Free water bodies, such as lakes, rivers, and oceans, would not be baited (see Section 2.2.7).

The primary goals of this program would involve the continuation and expansion of the national rabies management program to National Forest System lands in attempt to: 1) stop the forward advance of this strain of rabies from areas where it now occurs by immunizing portions of target species populations along the leading edges of the rabies fronts; and 2) reduce the incidence of rabies cases involving wild and domestic animals and rabies exposures to humans in the areas where the ORV programs are conducted. If the ORV program is successful in stopping the forward advance of this strain, then the ultimate goal could include elimination of this rabies variant. The inclusion of land areas managed by the federal government has become an increasingly important requirement for this program, given the extensive public lands within the ORV targeted zones (J.P. Koplan, M.D., Director, CDC, pers. comm. 2001). If baiting programs were conducted around these large land masses, reservoirs of the virus would likely still exist, creating holes in the program and potentially making the program less effective at stopping the forward advance or eliminating the raccoon strain of the rabies virus.

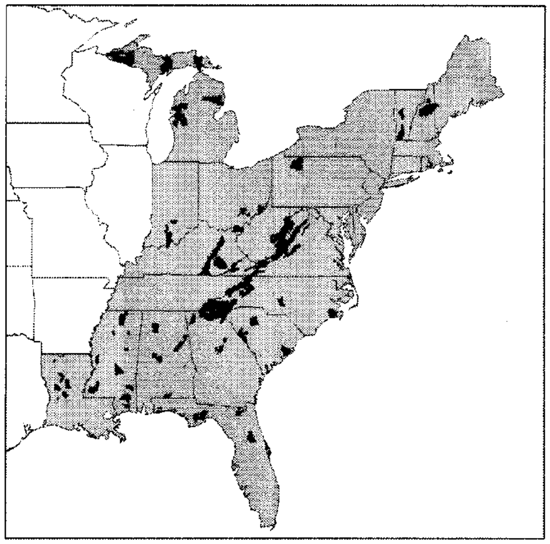

Figure 1-9. National Forest System lands (green) within respective states (yellow) in which APHIS-WS is proposing to continue or expand assistance to and participation in ORV programs. See also Appendix H for a listing of National Forest units in the program area.

Despite ongoing programs, the first case of raccoon rabies was confirmed in Ontario, Canada, during July 1999. Ontario does not want raccoon rabies and is working jointly with the U.S. to eliminate existing reservoirs of the raccoon variant of the rabies virus and prevent the spread of this disease into and within Canada. Efforts are underway to prevent the disease from becoming enzootic in this province (Rosatte 2000). The national rabies management program is dedicated to preventing additional cases from moving northward into Canada, in addition to preventing the westward spread of the virus.

The program would involve the use of APHIS-WS federal funds to purchase and distribute ORV baits to create zones of vaccinated target species that would then serve as barriers to cease the further advancement of raccoon rabies virus variants. Vaccination zones would be determined in cooperation with the various state rabies task forces, state health or agriculture departments, and/or other agencies with jurisdiction over vaccine use and application in wildlife and domestic animal species. ORV baits could also be used in other areas where the raccoon rabies virus variant is known to occur with the goal of eliminating those variants from such areas. The proposed action would also include APHIS-WS assistance in monitoring and surveillance activities involving the capture and release or lethal collection of the targeted animal species in the above states to take biological samples for testing to determine the effectiveness of the ORV programs. APHIS-WS could also assist the states in implementing contingency plans that include the localized population reduction of the target species in areas where rabies outbreaks occur beyond ORV barriers. The role of the USFS would involve cooperation with APHIS-WS in permitting access to National Forest System lands for bait disbursal and rabies monitoring and surveillance activities.

A portion of APHIS-WS federal funds would be used to: 1) purchase ORV baits and participate in the distribution of ORV baits by air and ground placement on National Forest System lands within the ORV zone; 2) provide other forms of assistance in monitoring rabies and determining the effectiveness of the ORV programs through collection and testing of samples from wild animal specimens on National Forest System lands; and, 3) if necessary, participate in implementing contingency plans on National Forest System lands that may involve the localized reduction of target species populations through lethal means (coordination with specific National Forests would occur prior to project implementation).

Biological data such as sex, age, and weight would also be collected to determine if baits are consumed differently by various age or sex groups. For example, juvenile male raccoons are the most likely age/sex group to disperse from the home range in which they were born and are, therefore, the cohort which would be most important to vaccinate. Enhanced surveillance (using sick and strange-acting target and nontarget wildlife, nuisance wildlife captured during other APHIS-WS damage management activities, and road-killed wildlife) would be conducted to track the occurrence of rabies within the ORV bait zones and to determine the epizootic front of the virus, so that ORV and other measures (i.e., trap-vaccinate-release) may be implemented ahead of these cases to maintain the integrity of the barrier.

Wild animal collections for purposes of monitoring would be conducted using a variety of live capture or lethal methods. Information from raccoons would be predominantly collected from cage-trapped individuals that, if apparently healthy, would normally be released at or near their site of capture. Only legally approved methods would be used in all animal sample collection areas to provide critical data for the evaluation of project effectiveness. Project effectiveness would be based in large part on the percentage of ORV baits consumed in populations of target species, the presence of sufficient levels of serum neutralizing antibodies in a large enough percentage of the population to resist the spread of rabies, and the absence of the rabies strain targeted for control with ORV beyond the vaccination zone established to prevent spread of the virus.

The ORV that would be used is the V-RG vaccine which is placed in two different types of baits as described in Section 1.1.4. The individual baits may also contain tetracycline, a nontoxic biomarker. The purpose of the biomarker is to aid in determining whether animals collected for monitoring purposes have eaten one or more baits. The effectiveness of the vaccine can be assessed by determining the proportion of animals that have eaten baits that have also been successfully vaccinated against rabies.

The areas in which the ORV baits would be distributed and from which animal specimens would be collected could be anywhere on National Forest System lands, excluding Wilderness Areas, in some or all of the states listed in the proposed action. National Forest System lands proposed for inclusion in this ORV program are listed in Appendix H. Coordination with specific National Forests would occur prior to project implementation to ensure that the integrity of specially designated areas is maintained (i.e., Research Natural Areas, Wild and Scenic Rivers, etc.). The ORV zones would be delineated based on the most current distribution of rabies cases and the expected direction of disease spread. Vaccination zones would be determined in cooperation with state rabies task forces, state health departments, and/or other state agencies with jurisdiction over vaccine use and application in wildlife and domestic animal species. Figure 1-3 shows the current areas anticipated to be treated or to continue treatment with ORV baits. Pending the verification of legal authorities to do so, ORV baits would be distributed by the states over a variety of National Forest System lands. Each individual bait would have a warning label advising persons not to handle or disturb the bait along with a toll-free telephone number to call for further information.

In the event that the targeted rabies strain advances beyond the barriers created by the ORV zones, contingency plans may be implemented by the involved states that could include local population reduction of the target wildlife species using lethal means combined with the distribution of higher densities of ORV baits in and around such areas. Any localized lethal population reduction efforts would likely be integrated with hand or aerial placement of ORV baits in and around the population reduction area to restore the integrity of the ORV zone and prevent further spread of rabies. APHIS-WS may, as part of the proposed action, assist in such efforts by providing funds, personnel, or equipment to capture and/or kill target species. Should this occur, methods used would involve any of those described above for the collection of wild animal specimens.

The Contingency Action Planning Team, part of the Rabies Management Team, has evaluated practical alternatives to address rabies threats that may compromise the integrity of ORV efforts. The team is finalizing contingency action recommendations that may be taken if any of the following occur (Slate et al. 2002):

- rabies intensifies approaching an ORV zone
- "hot spots" occur within a zone
- rabies breaches an ORV barrier, but is detected just beyond the vaccination zone
- rabies occurs as an isolated focus sufficiently distant from an ORV zone to suggest translocation, intentional or unintentional, was the source of the focus (such as with the current Long Island outbreak that was likely caused by "hitch-hiking" raccoons in garbage trucks using a landfill in the area).

1.3 AUTHORITIES

1.3.1 Federal Authorities.

Act of March 2, 1931 (7 U.S.C. 426-426b and 426c). APHIS-WS is authorized to conduct programs to address wildlife-caused disease problems, including the suppression of rabies in wildlife, by the Act of March 2, 1931, as amended.

7 U.S.C. Sec. 147b. This law authorizes the Secretary of Agriculture, in connection with emergencies which threaten any segment of the agricultural production industry of the U.S., to transfer from other appropriations or funds available to the agencies or corporations of USDA such sums as the Secretary may deem necessary, to be available only in such emergencies for the arrest and eradication of contagious or infectious diseases of animals. It is under this authority that funds from the federal Commodity Credit Corporation have been transferred to APHIS-WS to expend for the continuation and expansion of ORV programs in the states identified herein (65 FR 76606-76607, December 7, 2000).

National Forest Management Act of 1976 (16 U.S.C. section 1600 [note]). This law amended the Forest and Rangeland Renewable Resources Planning Act of 1974, which called for the management of renewable resources on National Forest lands. The National Forest Management Act requires the Secretary of Agriculture to assess forest lands, develop a management program based on multiple-use, sustained-yield principles, and implement a resource management plan for each unit of the National Forest System. This Act is the primary statute governing the administration of National Forests.

Cooperative Forestry Assistance Act of 1978 (16 U.S.C. section 2101 [note]). This law authorizes the Secretary of Agriculture to assist in controlling forest insects and diseases directly on National Forest System lands and in cooperation on other federal and non-federal lands of all ownerships.

Virus-Serum-Toxin Act (21 U.S.C. 151 et seq.). The Virus-Serum-Toxin Act (VSTA) became law in 1913 and was amended in 1985. The VSTA regulates the preparation and sale of biologic products used in animals. The oral rabies vaccine (RABORAL V-RG®) is licensed for treatment of raccoons and coyotes by the USDA under this Act. Animal vaccines shipped in or from the U.S. must be prepared under a USDA license. Animal vaccines may not be imported without a USDA license. Federal regulations implementing the VSTA (9 CFR 103.3) require authorization by APHIS before an experimental biological product can be shipped for the purpose of treating limited numbers of animals as part of an evaluation process. The license for RABORAL V-RG® requires that it be restricted for use in state or federal rabies control programs.

Public Health Service Act. The CDC, located in Atlanta, Georgia, is an agency of the U.S. Department of Health & Human Services. CDC's mission is to promote health and quality of life by preventing and controlling disease, injury, and disability. CDC is authorized under 42 U.S.C. 241 to render assistance to other appropriate public authorities in the conduct of research, investigations, demonstrations, and studies relating to the causes, diagnosis, treatment, control, and prevention of physical and mental diseases and impairments of man. Additionally, under 42 U.S.C. 243(a), the Secretary of Health & Human Services, may assist states and their political subdivisions in the prevention and suppression of communicable diseases.

1.3.2 State and Local Authorities

Each of the states involved in this proposed action has a state agency or agencies with authority under state law to approve, conduct or coordinate rabies control programs. APHIS-WS involvement in rabies control in each state has previously occurred and, under the proposed action, would only occur in complete cooperation with the appropriate state agency(ies) and in accordance with state authorities as identified by those agencies.

With regard to ORV programs, it is the various cooperating states that exercise their authorities under state law to propose or approve the distribution of ORV baits onto lands owned or managed by a variety of entities including private persons, federal land management agencies (e.g., USFS, National Park Service, and others), state, county, and city governments, and American Indian Tribes. It is critical to the success of establishing and maintaining ORV barriers and, potentially, to the eventual elimination of the targeted rabies strain in many areas, that all lands containing substantial amounts of habitat for the targeted carnivore species be included. APHIS-WS would not be making the decision to distribute baits on the various land ownerships. Those decisions would be made by the states. The proposed action assumes that ORV baits would be distributed under state authorities, consistent with pertinent property rights, laws, and regulations and would include acquiring permission from public land managers and American Indian Tribes when appropriate.

1.4 OTHER RELEVANT FEDERAL LAWS AND REGULATIONS

National Environmental Policy Act of 1969, as amended (NEPA) (42 U.S.C. 4321 et seq.). The purpose of NEPA is to declare a national policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nation; and to establish a Council on Environmental Quality.

APHIS-WS prepares analyses of the environmental impacts of program activities to meet procedural requirements of this law. APHIS has previously prepared a number of environmental assessments (EAs) to address the environmental effects of experimental programs using V-RG ORV baits and covering the approval of licensing of the vaccine for use in raccoons (see Section 1.5). APHIS-WS also completed an EA and Finding of No Significant Impact (FONSI) (USDA 2001a), dated July 30, 2001; a supplemental FONSI (USDA 2002), dated August 5, 2002; a supplemental EA and FONSI (USDA 2003), dated June 12, 2003; and a supplemental EA and FONSI (USDA 2004a), dated September 9, 2004. These documents analyzed the environmental effects of APHIS-WS involvement in the funding of and participation in ORV programs to eliminate or stop the spread of raccoon rabies in 25 eastern states (ME, NY, VT, NH, PA, OH, VA, MA, MD, NJ, WV, TN, KY, AL, GA, FL, NC, SC, DE, LA, MS, CT, RI, MI, and IN) and gray fox and coyote rabies in Texas. APHIS-WS determined the action would not have any significant impact on the quality of the human environment (see Section 1.5). Furthermore, APHIS-WS, in cooperation with the USFS, prepared an EA and FONSI (2004b), dated February 12, 2004. This document analyzed the environmental effects of APHIS-WS involvement in the funding of and participation in ORV programs on several National Forest System lands (excluding Wilderness Areas) in the eastern U.S. to eliminate or stop the spread of raccoon rabies. APHIS-WS determined the action would not have any significant impact on the quality of the human environment (see Section 1.5).

Coastal Zone Management Act of 1972, as amended (CZMA) (16 USC 1451-1464, Chapter 33; P.L. 92-583, October 27, 1972; 86 Stat. 1280). The CZMA established a voluntary national program within the Department of Commerce to encourage coastal states to develop and implement coastal zone management plans. Funds were authorized for cost-sharing grants to states to develop their programs. Subsequent to federal approval of their plans, grants would be awarded for implementation purposes. In order to be eligible for federal approval, each state's plan was required to define boundaries of the coastal zone, identify uses of the area to be regulated by the state, determine the mechanism (criteria, standards or regulations) for controlling such uses, and develop broad guidelines for priorities of uses within the coastal zone. In addition, this law established a system of criteria and standards for requiring that federal actions be conducted in a manner consistent with the federally approved plan. The standard for determining consistency varied depending on whether the federal action involved a permit, license, financial assistance, or a federally authorized activity.

APHIS-WS submitted a National Consistency Determination concerning the potential effects of the national rabies management program on coastal zone resources to all potentially affected states with approved coastal management programs (AL, CT, DE, FL, GA, IN, LA, ME, MD, MA, MI, MS, NH, NJ, NY, NC, OH, PA, RI, SC, and VA). APHIS-WS received concurrence that the national rabies management program would have *de minimus* (15CFR930.33) cumulative or secondary effects on coastal resources. Thus, APHIS-WS has determined the national rabies management program to be consistent with the CZMA and associated coastal zone management programs within the potentially affected coastal zone states and the program is excluded from further state agency consistency review.

Endangered Species Act (ESA) (16 U.S.C. 1531 et seq.). It is federal policy, under the ESA, that all federal agencies shall seek to conserve threatened and endangered (T&E) species and shall utilize their authorities in furtherance of the purposes of the Act (Sec.2(c)). For actions that "may affect" listed species, APHIS-WS conducts

Section 7 consultations with the U.S. Fish and Wildlife Service (USFWS) to ensure that "*any action authorized, funded or carried out by such an agency . . . is not likely to jeopardize the continued existence of any endangered or threatened species . . . Each agency shall use the best scientific and commercial data available*" (Sec.7(a)(2)). APHIS-WS has analyzed the potential for effects on listed species in this EA and has concluded that the proposed action would not affect any listed species (see Section 4.1.3).

National Historical Preservation Act (NHPA) of 1966 as amended (16 U.S.C. 470). The NHPA and its implementing regulations (36 CFR 800) require federal agencies to: 1) determine whether activities they propose constitute "undertakings" that can result in changes in the character or use of historic properties and, 2) if so, to evaluate the effects of such undertakings on such historic resources and consult with the State Historic Preservation Office regarding the value and management of specific cultural, archaeological and historic resources, and 3) consult with appropriate American Indian tribes to determine whether they have concerns for traditional cultural properties in areas of these federal undertakings.

ORV activities described under the proposed action (Section 1.2) do not cause major ground disturbance, do not cause any physical destruction or damage to property, do not cause any alterations of property, wildlife habitat, or landscapes, and do not involve the sale, lease, or transfer of ownership of any property. In general, such methods also do not have the potential to introduce visual, atmospheric, or audible elements to areas in which they are used that could result in effects on the character or use of historic properties. Therefore, the methods that would be used under the proposed action are not generally the types of activities that would have the potential to affect historic properties. If an individual activity with the potential to affect historic resources is planned under an alternative selected as a result of a decision on this EA, then site-specific consultation as required by Section 106 of the NHPA would be conducted as necessary.

Federal Food, Drug, and Cosmetic Act (21 U.S.C. 360). This law places administration of pharmaceutical drugs, including those used in wildlife capture and handling, under the Food and Drug Administration.

Controlled Substances Act of 1970 (21 U.S.C. 821 et seq.). This law requires an individual or agency to have a special registration number from the federal Drug Enforcement Administration (DEA) to possess controlled substances, including those that are used in wildlife capture and handling.

Animal Medicinal Drug Use Clarification Act of 1994 (AMDUCA). The AMDUCA and its implementing regulations (21 CFR Part 530) establish several requirements for the use of animal drugs, including those used to capture and handle wildlife in rabies management programs. Those requirements are: (1) a valid "veterinarian-client-patient" relationship, (2) well defined record keeping, (3) a withdrawal period for animals that have been administered drugs, and (4) identification of animals. A veterinarian, either on staff or on an advisory basis, would be involved in the oversight of the use of animal capture and handling drugs under the proposed action. Veterinary authorities in each state have the discretion under this law to establish withdrawal times (i.e., a period of time after a drug is administered that must lapse before an animal may be used for food) for specific drugs. Animals that might be consumed by a human within the withdrawal period must be identified; the Western Wildlife Health Committee of the Western Association of Fish and Wildlife Agencies has recommended that suitable identification markers include durable ear tags, neck collars, or other external markers that provide unique identification (WWHC *undated*). APHIS-WS establishes procedures in each state for administering drugs used in wildlife capture and handling that must be approved by state veterinary authorities in order to comply with this law.

Wilderness Act of 1964 – An Act (Public Law 88-577; 88th Congress, S.4; September 3, 1964). The Wilderness Act allows federally owned lands meeting specific criteria to be designated as "wilderness areas." The act prohibits and restricts certain uses of these designated lands. The act provides special provisions to allow certain activities to take place within designated wilderness areas such as the use of aircraft to control fire, insects and diseases (Sec. 4 (d)).

Clean Air Act of 1970 as amended (42 U.S.C. 7401). The Clean Air Act is a comprehensive federal law that regulates air emissions from area, stationary, and mobile sources.

1.5 RELATIONSHIP TO OTHER ENVIRONMENTAL DOCUMENTS

Work Plan for Oral Vaccination by Ground or Aerial Baiting to Control Specific Rabies Virus Variant in Raccoons on National Forest System Lands in USFS Regions 8 and 9. This Work Plan has been prepared by APHIS-WS in coordination with the USFS to implement ORV program activities on National Forest System lands in USFS Regions 8 and 9.

The USFS has reviewed the proposed action and alternatives described in this EA and has determined the proposed action to be consistent with Land and Resource Management Plans for the National Forests listed in Appendix H and excluding Wilderness Areas.

A number of other NEPA documents have been prepared that analyzed the potential environmental effects of ORV programs and the methods used in rabies monitoring and surveillance. Pertinent information from those analyses has been incorporated by reference into this EA.

Wildlife Services Programmatic EIS. APHIS-WS has issued a final Environmental Impact Statement (EIS) (USDA 1997) and Record of Decision on the National APHIS-WS Program.

EA and Finding of No Significant Impact – Oral Vaccination to Control Specific Rabies Virus Variants in Raccoons, Gray Foxes, and Coyotes in the United States. This EA included several supplements: EA and FONSI (USDA 2001a), dated July 30, 2001; a supplemental FONSI (USDA 2002), dated August 5, 2002; a supplemental EA and FONSI (USDA 2003), dated June 12, 2003; and a supplemental EA and FONSI (USDA 2004a), dated September 9, 2004. These documents analyzed the environmental effects of APHIS-WS involvement in the funding of and participation in ORV programs to eliminate or stop the spread of raccoon rabies in 25 eastern states (ME, NY, VT, NH, PA, OH, VA, MA, MD, NJ, WV, TN, KY, AL, GA, FL, NC, SC, DE, LA, MS, CT, RI, MI, and IN) and gray fox and coyote rabies in Texas. APHIS-WS determined the action would not have any significant impact on the quality of the human environment.

EA and Finding of No Significant Impact – Oral Vaccination to Control Specific Rabies Virus Variant in Raccoons on National Forest System Lands in the United States. This EA and its FONSI (USDA 2004b), dated February 12, 2004, was prepared by APHIS-WS in cooperation with the USFS. This document analyzed the environmental effects of APHIS-WS involvement in the funding of and participation in ORV programs on several National Forest System lands (excluding Wilderness Areas) in the eastern U.S. to eliminate or stop the spread of raccoon rabies. APHIS-WS determined the action would not have any significant impact on the quality of the human environment

EA and Finding of No Significant Impact – Proposed Issuance of a Conditional United States Veterinary Biological Product License to Rhone Merieux, Inc., for Rabies Vaccine, Live Vaccinia Vector. This EA and its FONSI dated April 7, 1995, was prepared by APHIS and concluded there would be no significant impact on the quality of the human environment from the decision to issue the conditional license referred to above (USDA 1995a). The conditional license approved the use of V-RG in raccoon rabies control programs administered under the direction of state or federal government agencies. Mitigative measures required under the decision included public education and notification efforts prior to distributing the baits, and the placement of warning labels on each vaccine-laden bait.

EA and Finding of No Significant Impact – Proposed Field Application of an Experimental Rabies Vaccine, Live Vaccinia Vector, in South Texas. This EA and its Decision/FONSI completed in 1995 analyzed the environmental effects of experimental distribution of ORV baits containing V-RG to eliminate and stop the spread of coyote rabies in South Texas (USDA 1995b). APHIS determined the action would not have any significant impact on the quality of the human environment.

EAs and Findings of No Significant Impact on proposed field trials/tests of live experimental vaccinia-vector recombinant rabies vaccine for raccoons. APHIS analyzed the potential environmental impacts of six separate field trials or tests of the recombinant V-RG vaccine in several northeastern states. In EAs and Decisions/FONSIs covering those actions, (USDA 1991, 1992, 1993, 1994a, 1994b, 1994c), APHIS determined that none of the actions would have any significant impact on the quality of the human environment.

Risk Analyses for ORV using the V-RG recombinant virus. Two formal risk analyses on the rabies vaccine -- live vaccinia vector (i.e., the recombinant V-RG vaccine) have been prepared previously by APHIS (USDA *undated a, undated b*). Both analyses concluded the risk of adverse animal safety, human safety, or other environmental effects to be low.

1.6 EXECUTIVE ORDER ON ENVIRONMENTAL JUSTICE

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations requires federal agencies to analyze disproportionately high and adverse environmental effects of proposed actions on minority and low-income populations. APHIS-WS has analyzed the effects of the proposed action and determined that implementation would not have adverse human health or environmental impacts on low-income or minority populations.

1.7 EXECUTIVE ORDER ON PROTECTION OF CHILDREN FROM ENVIRONMENTAL HEALTH AND SAFETY RISKS

Executive Order 13045 was passed to help protect children who may suffer disproportionately from environmental health and safety risks for many reasons. ORV activities as proposed in this EA would only involve legally available and approved methods that have been subjected to safety evaluations and testing. The vaccinia virus used as a carrier of the rabies glycoprotein is the same type of virus that was used in smallpox eradication, although more attenuated or weakened (USDA 1991). The analysis in Section 4.2.1 of this EA supports a conclusion of very low to no risk of adverse effects on children from the ORV baiting strategy. Implementation of the proposed action would not increase environmental health or safety risks to children, but would in fact reduce such risks by minimizing the potential for children to contract rabies. Children are particularly at risk from rabies because they are more prone to experiencing "undetected" or "unappreciated" exposures (Huntley et al. *unpublished* 1996) that do not lead to post-exposure vaccine treatments. Therefore, federal involvement in ORV programs is consistent with and helps to achieve the goals of Executive Order 13045.

1.8 GOALS

As stated in the description of the proposed action, the primary goals of the program are to include additional National Forest System lands within the ORV program to:

- stop the forward advance of the raccoon strain of rabies from areas where it now occurs by immunizing portions of target species populations along the leading edges of the rabies fronts; and

- reduce the incidence of rabies cases involving wild and domestic animals and rabies exposures to humans in the areas where the ORV programs are conducted.

A Work Plan between the USFS and APHIS-WS has been prepared regarding implementation of ORV programs on National Forest System lands. Additionally, the states that would be involved in the proposed action have established, or are in the process of establishing, plans for the implementation of ORV programs. The proposed action would be consistent with such plans and any statements of goals and objectives as they are developed by the involved state and federal agencies.

1.9 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT ANALYSIS

1.9.1 Actions Analyzed.

This supplemental EA evaluates the environmental effects of continuing and expanding APHIS-WS participation in ORV programs on National Forest System lands in a number of eastern states to eliminate or stop the spread of raccoon rabies.

1.9.2 Period for which this EA is Valid.

This supplemental EA will remain valid until APHIS-WS determines that new needs for action, new unforeseen significant issues, or new alternatives having different environmental effects must be analyzed. At that time, this analysis and document will be supplemented or revised pursuant to NEPA. Review of the EA will be conducted each year by APHIS-WS to ensure that the EA and the analyses contained herein are still appropriate.

1.9.3 Site Specificity.

This supplemental EA analyzes the potential impacts of continuing and expanding APHIS-WS participation in ORV programs on National Forest System lands in some or all of the states described in Section 1.2. Because the proposed action is to assist the affected states in accordance with plans, goals, and objectives developed by those states, the proposed action could involve APHIS-WS participation in ORV bait distribution and monitoring and surveillance or local population reduction of target species anywhere in those states where the need has been identified by the appropriate state agencies. Therefore, all National Forest System lands within the aforementioned states could be affected. National Forests within these states are listed in Appendix H. This EA identifies as much as possible the typical habitat areas and the specific areas that are currently known to be in need of ORV program action. However, the location of every wildlife rabies outbreak that would trigger use of ORV cannot be predicted. Implementation of emergency response and contingency action plans that involve localized population suppression of target species could similarly be needed anywhere in the involved states where outbreaks of the targeted rabies strain occurs. Additionally, changes in funding levels over time could create changes in ORV program activities, such as increasing or decreasing the size of the ORV zones and other areas to be baited and varying the types of monitoring and surveillance and research conducted.

Planning for the management of rabies epizootics must be viewed as being conceptually similar to federal or other agency actions whose missions are to stop or prevent adverse consequences from anticipated future events for which the actual sites and locations where they will occur are unknown but could be anywhere in a defined geographic area. Examples of such agencies and programs include fire and police departments, emergency clean-up organizations, insurance companies, etc. Although some of the sites where wildlife rabies outbreaks will occur can be predicted, all specific locations or times where such outbreaks will occur in any given year cannot be predicted. Thus, this supplemental EA addresses the substantive environmental issues that pertain to ORV use and monitoring/surveillance activities, and, if necessary, localized target species population reduction wherever these activities might occur on the National Forest System lands identified herein. The analyses in this supplemental EA are intended to apply to any action that may occur *in any locale, except Wilderness Areas,* and at *any time* within the analysis area. In this way, APHIS-WS believes it meets the intent of NEPA with regard to site-specific analysis and that this is the only practical way for APHIS-WS to comply with NEPA and still be able to accomplish its mission.

1.10 SUMMARY OF PUBLIC INVOLVEMENT EFFORTS

Several EAs have been prepared previously to analyze environmental effects of APHIS-WS' continued and expanded participation with an ORV program in several eastern states and Texas. Issues related to the proposed action were identified through involvement and planning/scoping meetings with state health departments, other state and local agencies, academic institutions, the Ontario Ministry of Natural Resources, and the CDC. Additional efforts to determine further issues that the public might have with ORV program implementation were made through a Federal Register Notice (66 FR 13696-13700, March 7, 2001) and by a second Federal Register Notice (66 FR 27489, May 17, 2001) making the EA available to the public for review and comment prior to an agency decision. A letter was sent to potentially affected or interested American Indian Tribes to assure their opportunity to be involved in the EA process. Comments received were reviewed to identify any substantive new issues or alternatives not already identified for analysis. A third Federal Register Notice (66 FR 45835-45836, August 30, 2001) was published announcing the availability of the EA Decision/FONSI (USDA 2001a). A Notice of Availability for a subsequent Decision/FONSI was published through a Federal Register Notice (67 FR 44797-44798, July 5, 2002) (USDA 2002). A Notice of Availability for supplemental or additional EAs and Decision/FONSIs were published through Federal Register Notices, 68 FR 38669-38670, June 30, 2003 (USDA 2003); 69 FR 7904-7905, February 20, 2004 (USDA 2004b); and 69 FR 56992-56993, September 23, 2004 (USDA

2004a). This supplemental EA has been prepared in cooperation with the USFS to continue and expand ORV program assistance on National Forest System lands, excluding Wilderness Areas, in several eastern states. A Notice of Availability for this supplemental EA and Decision/FONSI or Notice of Intent to prepare an EIS will be published in the Federal Register once a decision is reached.

2.0 CHAPTER 2: ISSUES AND AFFECTED ENVIRONMENT

2.1 ISSUES

From public input received in response to Federal Register notices, from interactions and planning/scoping meetings held with state and local departments of health and the CDC, and based on previous EAs and decisions (USDA 2001a, 2002, 2003, 2004a, 2004b) the following issues were determined to be germane to the proposed action and were considered in detail:

- Potential for adverse effects on people that become exposed to the vaccine or the baits.
- Potential for adverse effects on target wildlife species populations.
- Potential for adverse effects on nontarget wildlife species, including threatened or endangered species and species designated as sensitive by the USFS Regional Foresters.
- Potential for adverse effects on pet dogs or other domestic animals that might consume the baits.
- Potential for the recombined V-RG virus to "revert to virulence" and result in a virus that could cause disease in humans or animals.
- Potential for the V-RG virus to recombine with other viruses in the wild to form new viruses that could cause disease in humans or animals.
- Potential for aerially dropped baits to strike and injure people or domestic animals.
- Cost of the program in comparison to perceived benefits.
- Humaneness of methods used to collect wild animal specimens critical for timely program evaluation or to reduce local populations of target species under state contingency plans.

2.2 OTHER ISSUES CONSIDERED, BUT NOT IN DETAIL WITH RATIONALE

2.2.1 Potential for Drugs Used in Animal Capture and Handling to Cause Adverse Health Effects in Humans that Hunt and Eat the Species Involved.

This issue could be of concern for raccoons, which are hunted and sometimes consumed by people as food. Drugs used in capturing and handling raccoons for surveillance and monitoring purposes in rabies management programs include ketamine hydrochloride, xylazine (Rompun), and a mixture of tiletamine and zolazepam (Telazol). Meeting the requirements of the AMDUCA (see Section 1.4) should prevent any significant adverse impacts on human health with regard to this issue. Mitigation measures that would be part of the standard operating procedures (SOPs) followed in each state include:

- All drugs used in capturing and handling raccoons and other animals would be under the direction and authority of state or federal veterinary authorities, either directly or through procedures agreed upon between those authorities and APHIS-WS.
- As determined on a federal- or state-level basis by these veterinary authorities (as allowed by AMDUCA), ORV program participants may choose to avoid capture and handling activities that utilize immobilizing drugs within a specified number of days prior to the hunting or trapping season for the target species to avoid release of animals that may be consumed by hunters prior to the end of established withdrawal periods for the particular drugs used. However, capture and handling activities would likely extend into the hunting season during late summer/fall ORV baiting schedules. Therefore, target species would either be marked or euthanized if immobilizing drugs are used within 30 days of hunting or trapping seasons. These

measures are taken to avoid release of animals that may be consumed by hunters prior to the end of established withdrawal periods for the particular drugs used.

- Animals that have been immobilized and released would be ear tagged or marked in some other way to alert hunters and trappers that they should contact APHIS-WS personnel before consuming the animal.

By following these procedures in accordance with AMDUCA, rabies management programs would avoid any significant impacts on human health with regard to this issue.

2.2.2 Potential for Drugs Used in Animal Capture and Handling to Cause Adverse Health Effects in Scavengers or Other Nontarget Animals that May Consume the Species Involved.

Drugs used in the capturing and handling of raccoons for surveillance and monitoring purposes in the rabies management program include ketamine hydrochloride, xylazine (Rompun), and a mixture of tiletamine and zolazepam (Telazol). These drugs are generally injected intravenously or intramuscularly and, less-often, subcutaneously. Oral delivery of immobilizing drugs may be used to calm animals caught in traps. For example, oral delivery of ketamine can calm the animal enough to allow injection of additional drug via syringe (USDA 2001b). However, oral delivery is not recommended for anesthetizing the animal due to the much higher dosage required to compensate for the slower uptake rate and correct dosages cannot be guaranteed (USDA 2001b).

APHIS-WS personnel would not release an animal until it has returned to full and normal function, thereby reducing its chances of succumbing to potential predators or other dangers. Most immobilizing drugs used, such as ketamine and xylazine, are metabolized and excreted within hours after the animal returns to full function (Dr. L. Bigler, New York State Animal Health Diagnostic Laboratory, pers. comm. 2004). In addition, reversal agents, such as yohimbine, may be used to rouse the animal more quickly. Therefore, if a previously immobilized animal dies in the field sometime later, even if a scavenging animal were to ingest an entire animal previously immobilized, they should suffer no adverse effects (Dr. G. Gathright, DVM, APHIS-WS, National Wildlife Research Center, pers. comm. 2004). Furthermore, the scavenger would be consuming the animal by oral route, thus requiring a much larger dosage of the drug. Immobilizing drugs would produce carcasses that are not considered toxic to scavengers (USDA 2001b). If an animal must be euthanized, APHIS-WS personnel would remove it from the field immediately, thereby eliminating the chance of scavengers finding the carcass. As a result of these factors, immobilizing drugs would have no adverse effect on scavengers or predators that consume previously immobilized animals.

2.2.3 Potential for Adverse Impacts on Wildlife from Aircraft Overflights Conducted in ORV Programs.

The concern here is that certain wildlife species might be disturbed by the aircraft used in ORV bait distribution to the point that they are adversely affected.

The U.S. Department of the Interior (USDI) (1995) reviewed studies on the effects of aircraft overflights on wildlife. The report revealed that a number of studies have documented responses by certain wildlife species that suggest adverse impacts could occur. Few if any studies have proven that aircraft overflights cause significant adverse impacts on populations, although the report stated it is possible to draw the conclusion that impacts to wildlife populations are occurring. It appears that some species will frequently or at least occasionally show adverse responses to even minor overflight occurrences. In general, it appears that the more serious potential impacts occur when overflights are *chronic*, i.e., they occur daily or more often over long periods of time. Chronic exposure situations generally involve areas near commercial airports and military flight training facilities. ORV program aerial bait distribution activities are not chronic, but typically occur only once or twice per year. They are typically conducted at about 152.4 m (500 ft) above ground level and only fly momentarily over any one point on the ground during any given bait distribution flight. The aircraft do not circle over areas repeatedly, but fly in straight "transect" lines for purposes of bait distribution. The transect lines would be spaced at a minimum of 500 m (1640.4 ft) to a maximum of 750 m (2460.6 ft) apart.

Some examples of species or species groups that have been studied with regard to this issue and APHIS-WS determination of potential impacts from ORV aerial overflights are as follows:

- Colonial Waterbirds. Kushlan (1979) reported that low level [390 ft (118.8 m) followed by a second flight at 200 ft (60.9 m)] overflights of 2-3 minutes in duration by a fixed-wing airplane and a helicopter produced no "drastic" disturbance of tree-nesting colonial waterbirds, and, in 90 percent of the observations, the individual birds either showed no reaction or merely looked up. ORV program overflights typically occur at about 152.4 m (500ft) above ground and would only fly momentarily over any one point on the ground. Transect lines are also generally spaced between 500 m (1640.4 ft) and 750 m (2460.6 ft) apart. Thus, it appears that ORV program overflights would result in little or no disturbance to colonial waterbirds.

- Greater Snow Geese. Belanger and Bedard (1989, 1990) observed responses of greater snow geese (*Chen caerulescens atlantica*) to man-induced disturbance on a sanctuary area and estimated the energetic cost of such disturbance. They observed that disturbance rates exceeding two per hour reduced goose use of the sanctuary by 50 percent the following day. They also observed that about 40 percent of the disturbances caused interruptions in feeding that would require an estimated 32 percent increase in nighttime feeding to compensate for the energy lost. They concluded that overflights of sanctuary areas should be strictly regulated to avoid adverse impacts. ORV program overflights typically occur at about 152.4 m (500 ft) above ground and would only fly momentarily over any one point on the ground. Transect lines are also generally spaced between 500 m (1640.4 ft) and 750 m (2460.6 ft) apart. Thus, it appears that ORV program overflights would result in little or no disturbance to snow geese or other waterfowl species.

- Raptors. Andersen et al. (1989) conducted low-level helicopter overflights directly at 35 red-tailed hawk (*Buteo jamaicensis*) nests and concluded their observations supported the hypothesis that red-tailed hawks habituate to low level flights during the nesting period. Their results also showed similar nesting success between hawks subjected to such overflights and those that were not. White and Thurow (1985) did not evaluate the effects of aircraft overflights, but showed that ferruginous hawks (*Buteo regalis*) are sensitive to certain types of ground-based human disturbance to the point that reproductive success may be adversely affected. However, military jets that flew low over the study area during training exercises did not appear to bother the hawks, and neither were they alarmed when the researchers flew within 100 ft (30.5 m) in a small fixed-wing aircraft (White and Thurow 1985). White and Sherrod (1973) suggested that disturbance of raptors by aerial surveys with helicopters may be less than that caused by approaching nests on foot. Ellis (1981) reported that 5 species of hawks, 2 falcons, and golden eagles were "incredibly tolerant" of overflights by military fighter jets, and observed that, although birds frequently exhibited alarm, negative responses were brief and never limiting to productivity. These studies indicate that overflights by ORV program aircraft should have no significant adverse impacts on raptor populations by affecting nesting success.

- Bald Eagles. Several studies have shown that bald eagles (*Haliaeetus leucocephalus*) elicited varied responses (e.g., no response, alert, agitation, or flushing) by overflights of different types of aircraft such as military jets, fixed-wing aircraft, light planes, and helicopters (Grubb and Bowerman 1997, Watson 1993, Stalmaster and Kaiser 1997). Helicopters appeared to produce the greatest response, with military jets second, and fixed wing and light planes third (Grubb and Bowerman 1997, Watson 1993, Stalmaster and Kaiser 1997). The frequency of response and frequency of flight by bald eagles both increased through the nesting season from February to June (Grubb and Bowerman 1997). However, bald eagles were disturbed at higher rates when there were no young in the nest, when they were away from the nest, or when helicopters were hovering rather than moving (Watson 1993). The distance between eagle and aircraft, overflight duration, number of passes over nest, and type of aircraft appeared to be the most important characteristics influencing eagle responses (Grubb and Bowerman 1997, Watson 1993, Stalmaster and Kaiser 1997). However, Grubb and King (1991) concluded breeding bald eagles in Arizona may have become habituated to aircraft. Habituation was also reported at a nest site near a military air base in Michigan (Grubb et al. 1992, Grubb and Bowerman 1997). Nesting bald eagles have also been surveyed from fixed-wing aircraft with minimal disturbance (Fraser et al. 1985, Watson 1993). In general, conclusions about adverse effects on bald eagles and other raptors from aircraft overflights appear to be speculative. However, no direct evidence of adult or young mortality during helicopter or fixed-wing overflights has been observed (Watson 1993, Fraser et al. 1985). Although habituation may occur, most findings supported the use of buffer zones to distance nesting bald eagles from aircraft activity. Watson (1993) recommended helicopters remain at a distance greater than 197 ft (60 m) from nests. Stalmaster and Kaiser (1997) suggested a buffer of 1312-2625 ft (400-800 m) between wintering bald eagles and military activity such as boats, aircraft, and explosions. Grubb and Bowerman (1997) recommended any type of human activity be conducted at a distance of 1312 ft (400 m) or greater from nesting bald eagles. If this limitation is impractical, they recommended that duration and numbers of aircraft and/or passes are limited to less than 5 minutes and to one aircraft and/or pass. This scenario would be expected for rabies bait distribution overflights, which would only involve one overflight pass, once per year, in which the duration of the pass over a given nest site would only be a few seconds at most.

Occasional overflights (i.e., radio telemetry, GIS mapping, general aviation and commercial flights, and military training routes by fighter jets, helicopters, and/or transport ships) may occur over National Forest System lands. Overflights for the purposes of ORV bait distribution activities would only occur once or twice per year and aircraft would only fly momentarily over any one point on the ground. The aircraft do not circle over areas repeatedly, but fly in straight "transect" lines for the purposes of bait distribution. The potential impact would be of short-term (only momentary) duration, on a local scale, with negligible intensity and should not add appreciably to the frequency of overflights. The addition of one more overflight per year for ORV bait distribution should not constitute a substantive increase in any effects that might occur as a result of overflights. Furthermore, the types of aircraft used in bait distribution, the DeHavilland (DHC-6) Twin Otter and Beechcraft King Air B200, meet all Federal Aviation Regulation (FAR) requirements regarding noise limits (FAR Part 36, Appendix F). Therefore, cumulative impacts from the combination of ORV bait distribution overflights and other overflights should be negligible. Thus, the short-term duration, infrequency, and negligible intensity of flights over any given area, in addition to the tolerance of wildlife of such activity, indicates ORV program overflights would have a negligible adverse environmental impact on wildlife.

2.2.4 Potential for ORV Bait Distribution to Affect Organic Farming.

This issue concerns the potential for ORV baits dropped on crops and livestock operations certified as "organic" under federal regulations to affect the status of the organic certification of such farms. Farmers and livestock producers were concerned they would not be able to sell, label, or represent their harvested crop or plant as organically produced if it had contact with the prohibited substance, which is the vaccine V-RG (CFR7 Part 205.672). In particular, this concern was raised by a producer of organically raised venison in Ohio (R. Krogwold, Ohio Dept. of Health, pers. comm. 2001) and by an organic farmer in Florida (H. McConnell, APHIS-WS, pers. comm. 2003).

The ORV baits are comprised of a matrix of fishmeal and an ethylene copolymer which is a plastic material. The purpose of the polymer is to hold the fishmeal attractant together in a block that can withstand being dropped from an airplane and that will not dissolve or crumble apart readily when and if it is exposed to rain or melting snow. The process for producing the bait blocks eliminates all potentially reactive compounds (such as ethylene and vinyl acetate) that might have the potential for uptake by plants or absorption into the tissues of animals that consume the baits. Thus, the inorganic polymer in the ORV baits is totally nonreactive and cannot be absorbed by plants or animals (M. Smith, Bait-Tek, pers. comm. 2001). It is also among the types of materials approved by the Food and Drug Administration for use in producing, manufacturing, packing, processing, preparing, treating, packaging, transporting, or holding food (21 CFR Part 177). Therefore, the fishmeal polymer baits should pose no risk of contaminating crops or animals raised for food and, consequently, should have no effect on the ability of certified organic farms to maintain their status.

Field baiting studies suggest deer are not generally attracted to the ORV baits. Out of more than 4,300 baits exposed to target and nontarget animals in field bait acceptance studies in Georgia, Ohio, and Texas, none were observed to have been taken or consumed by deer, despite the prevalence of deer in the areas where the bait studies were conducted (Linhart et al. 2002). Sulfur compounds are a byproduct of the breakdown of animal proteins, including those found in fishmeal (D. Nolte, APHIS-WS, NWRC, pers. comm. 2001) and are generally repellent to herbivores (Nolte et al. 1994). Therefore, the ORV baits used to address raccoon rabies problems are probably at least somewhat repellent to deer, which probably accounts in part for the lack of observed bait take by deer in the studies reported in Linhart et al. (2002). For these reasons, it is unlikely that the ORV baits would be consumed by deer on venison farms that are certified as organic producers.

On April 15, 2003, the USDA-Agricultural Marketing Service (AMS) ruled that ORV bait blocks, consisting of a vaccine imbedded in fishmeal bound by a polymer binding agent, on an organic operation would not have an adverse impact on organic operations (see USDA-AMS letter in Appendix G). This ruling was posted on the USDA-AMS website at www.ams.usda.gov/nop. The USDA-AMS considers the ORV program to be an emergency disease treatment for the control of rabies and, as such, is addressed under National Organic Program (NOP) section 205.672, Emergency Pest or Disease Treatment. The USDA-AMS determined that "…in the unlikely event that a bait block breaks and exposes a plant(s) to the vaccine, the organic producer can remove the affected plant(s) with no adverse effect on the operation's certification. This would comply with NOP section 205.672(a). The organic status of animals feeding on the ORV bait block and not penetrating the vaccine would not be adversely affected. In the unlikely event that an animal consumes the vaccine within the ORV bait block that animal will lose organic status as provided in NOP section 205.672(b)." The USDA-AMS believes there to be little chance that an organic animal will consume the vaccine within an ORV bait block; however, to reduce the chances of livestock consumption, producers can relocate any bait found within an area containing livestock to a point outside of that area.

2.2.5 Potential for ORV to Cause Abortions in Cattle.

This issue was raised by a cattle producer in Ohio who reported an increase in abortions of pregnant cows following an ORV bait distribution project. V-RG vaccine was tested in a number of wild and domestic animal species, including cattle, and produced no adverse effects (see Section 4.2.3.1). Although pregnant cattle have not been specifically tested, V-RG has produced no adverse effects on gestation in pregnant female raccoons (C. Rupprecht, CDC, pers. comm. to K. Smith, Ohio Dept. of Health 2001). Relatively recently, a woman who was 18 weeks pregnant in Ohio was exposed to the vaccine when she took a bait away from her dog and later delivered a healthy 10-lb. baby boy (see Section 4.2.1.2). ORV program administrators with the Texas Department of Health have not received any reports of this nature despite the distribution of millions of ORV baits in cattle and other livestock production areas since 1995 (E. Oertli, TX Dept. of Health, pers. comm. 2001). In the U.S., approximately 55.3 million doses of V-RG have been distributed by APHIS-WS to date without any other reported concerns of this nature being raised. Therefore, the reported increase in cattle abortions was determined to be coincidental and not related to ORV. The Ohio producer was provided with further information and advice on determining which of a number of other known possible causes of abortions in cattle might be responsible (R. Hale, Ohio Dept. of Health, pers. comm. 2001).

2.2.6 Potential Human Health Impacts in the Event of Human Consumption of Vaccinated Wildlife.

The issue expressed here concerns the potential to develop a vaccinia infection from eating a vaccinated raccoon or some other animal that has eaten one or more ORV baits. Dr. Carolin Schumacher of Merial, Inc. was consulted to obtain information on this issue. Mahnel (1987) reported results of experiments to determine the stability of poxviruses (which include vaccinia used in the V-RG vaccine). "Naked" vaccinia (i.e., vaccinia found outside of host cells) will be inactivated within minutes by heat above 56 degrees Celsius (133 degrees Fahrenheit), by ultra-violet irradiation (sunlight), or by exposure to acid with a pH of 3 or less[3] (e.g., similar to the acid environment found in the stomach of raccoons which is where the bulk of V-RG vaccine would end up). In contrast, however, poxviruses can be relatively stable for years in dry dust or in dried lesion crusts.

The vaccinia from V-RG would generally only bind to animal tissues in the mucous membrane of the oral cavity, pharynx and esophagus since V-RG does not have the tendency to spread throughout the animal. Those particular tissues are rarely consumed by humans, but if they were, they would most likely be cooked which would kill the virus. Also, concentrations of vaccinia in those tissues should be low because mucosa is not considered a tissue where the virus tends to accumulate (C. Schumacher, Merial, Inc., pers. comm. 2001).

[3] pH is the measure of acidity or alkalinity of a solution with numbers below 7 representing a progressively more acidic solution. A pH of 3 is highly acidic.

Although cell-bound vaccinia is generally more resistant than free virus, humidity and cellular enzyme activity in the tissues as well as bacterial decomposition (e.g., in the gut of ruminants), normally results in inactivation of the virus. In the environment, inactivation of pox viruses is accelerated by temperature changes (C. Schumacher, Merial, Inc., pers. comm. 2001).

The above information suggests that possible sources of contamination with vaccinia would be V-RG dried onto the fur of an animal, ingested virus in the stomach, or cell-bound virus in mucous membranes. However, with the combined activity of sunlight and ultraviolet light, humidity, stomach pH and/or bacteria/enzymes, temperature fluctuations, and cooking heat, the risk to human health should be small, especially when taking into consideration the attenuated or weakened condition of the vaccinia in the V-RG vaccine. Therefore, the potential for adverse health effects from consuming animals that have eaten ORV baits should be negligible.

2.2.7 Potential Impacts on Water Resources, including Aquaculture, Fish, Reptiles, and Amphibians.

A concern has been expressed regarding the potential impacts of unconsumed V-RG vaccine and baits adversely impacting ground and surface water resources and aquaculture through direct and indirect exposure. Those baits that are not consumed may remain in the environment for several months after placement dependent upon environmental conditions (precipitation, temperature, etc.) and the physical condition of the baits. Potential impacts to water resources are greatly reduced by the limited number of baits that are dropped in a specific area, the biodegradability of the vaccine liquid and baits, the high consumption rate of ORV baits by animal species, the safety and efficacy of the vaccine, and the SOPs that are used when dropping baits near a large water source. This conclusion is based upon:

- The possibility of a large quantity of ORV baits being exposed to a site specific water resource is extremely low due to the bait distribution densities used by the program. Under the proposed program, ORV baits would be distributed from aircraft at an average density of 75 per sq km (28.96 per sq mi).

- The baits are non-toxic. The baits used for the ORV program are small blocks of fishmeal that are held together with a polymer binding agent and are considered to be "food grade" materials. Therefore, the unconsumed bait material would biodegrade when exposed to the environment causing little to no effect on water resources.

- The vaccinia virus and other orthopoxviruses will not replicate in water and do not replicate or reproduce themselves in non-warmblooded species (Rupprecht, CDC, pers. comm. 2002). Therefore, ORV is not expected to cause any adverse effects on fish, reptiles, amphibians, or any invertebrate species should any members of these species groups consume ORV baits or otherwise be exposed to the vaccine.

- The ORV baits are readily taken up and consumed by wildlife species, thereby limiting long term exposure to the environment. The likelihood of a bait being consumed is dependent upon several factors including animal population densities (target and nontarget species), bait preference, and the availability of alternative food sources. In field tests conducted in the U.S., the majority of ORV baits have been consumed within the first 7 to 14 days after placement, with reports of up to 100 percent of the baits being consumed within a 7 day period (Farry et al. 1998b, Hable et al. 1992, Hadidian et al. 1989, Hanlon et al. 1989a, Linhart et al. 1994, Steelman et al. 2000, USDA 1995a).

- The V-RG virus biodegrades when exposed to the environment. The V-RG virus that is not consumed by the target species or other vertebrates will become inactivated over a relatively short period of time. Persistence and stability of the V-RG virus outside of an organism is highly dependent on ambient temperature and local environmental conditions; the higher the temperature the quicker the virus will become inactive (USDA 1992, 1995a). For example at temperatures between 68 and 100 degrees Fahrenheit the liquid vaccine potency remains stable for approximately 14 to 7 days, respectively, in the un-punctured sachet or inside the bait. In situations where the bait and sachet are damaged inactivation of the V-RG virus will occur more rapidly. A more detailed discussion of the development of ORV baits can be found in Chapter 1.

- Program SOPs limit the possibility of ORV baits being directly dropped into large water sources such as rivers, lakes, and reservoirs. When the aircraft approaches a large body of water the bait dropping equipment is shut off approximately 0.25 mile from the water source to reduce the possibility of ORV baits falling into the water. Nevertheless, due to changing environmental conditions and the limited possibility of human error when operating the bait dropping equipment there is the possibility that baits may inadvertently be dropped into a body of water. Exposure of the V-RG vaccine into a water source from an intact bait and sachet is highly unlikely. The vaccine is enclosed in a sealed sachet thereby limiting the possibility of the vaccine liquid being directly released into a water source. Even if the vaccine was released into a water source through a damaged or punctured sachet, it is highly unlikely that the vaccine will cause any adverse affects since the vaccine liquid is biodegradable and nontoxic (USDA 1991, *undated a*, *undated b*).

The above information indicates that V-RG vaccine and baits pose no threat to groundwater or surface water through direct or indirect means.

2.2.8 Effects on Carnivore Populations in the Absence of Rabies.

Concern has been expressed that specific carnivore populations, namely raccoons, may increase in the absence of the rabies virus as a mortality factor, leading to adverse effects on prey populations such as threatened and endangered species. The raccoon strain of the rabies virus has only relatively recently spread, and currently is contiguously distributed from Alabama to Maine, west to the eastern Ohio border with Pennsylvania (Krebs et al. 2002, Kemere et al. 2001). Translocation of rabid raccoons to the mid-Atlantic states has been implicated in establishing a new rabies foci in the mid-1970's (Krebs et al. 1999), from which rabies has spread through the raccoon population at rates averaging about 30 miles/year (Kemere et al. 2001).

As a disease existing within natural systems, raccoon rabies is only one of several diseases which can influence dynamics of its vector and reservoir populations, and there is no indication that it has more serious effects on population levels than several other conditions. Milius (1998) noted that vaccinating raccoons in the city of Scarborough, Ontario against canine distemper in the early 1990s successfully reduced the prevalence of the disease in raccoons. The vaccination program did not trigger the population boom that some suggested. Canine distemper provides a good model for studying whether a disease regulates a population (Milius 1998). The cyclic nature of enzootic rabies suggests that it causes significant changes in numbers of animals, but direct evidence is fragmentary. Scientists have observed for years that raccoon populations decrease during the initial epizootic activities, but stabilize at pre-infestation levels after a few years (McLean, pers. comm. 2004).

In Europe and Ontario, an increase in fox densities coincided with reduction of rabies by oral vaccination, but was found to result from ecological changes as much as or more than from rabies control; increases occurred at the same times in regions which had no rabies (MacInnes and LeBer 2000). An Ontario Ministry of Natural Resources project trapped, vaccinated, and released skunks and raccoons for both rabies and canine distemper in certain areas of the City of Scarborough, Ontario. Researchers concluded that the vaccine had decreased the prevalence of the diseases (1.4 percent of raccoons infected versus 8.3 percent prior to implementation of the program), yet the program did not change overall growth trends in the raccoon population (Milius 1998). Canine distemper may have impacts as large as or larger than rabies on raccoon populations, but where measured explicitly during one outbreak it had only small effects. Parvoviruses, infectious canine hepatitis, and other viral diseases have potential to severely affect fox, skunk, and raccoon populations. The whole question of the influence of disease on wildlife numbers is complex and far from fully explained (MacInnes and LeBer 2000). From what is currently known about the interaction of the rabies virus and raccoons, significant changes in population numbers due to the treatment of the rabies are not common (McLean, pers. comm. 2004).

Guerra et al. (2003) does not support the idea that rabies exists specifically to control raccoon populations. Guerra et al. (2003) state that after an initial peak, populations approach lower 'steady-state' conditions. Based on surveillance data, raccoon rabies did not exist outside a focus in Florida before the 1940s. Therefore, elimination of raccoon rabies should merely create the scenario before raccoon rabies spread in the eastern U.S. (Rupprecht and Smith, 1994). No evidence exists that the carrying capacity for raccoons could be increased by the implementation of ORV programs compared to population levels before the introduction of rabies (C. Rupprecht, CDC, pers. comm. 2003).

Prior to the introduction of raccoon rabies into the mid-Atlantic region in the late 1970's, canine distemper was considered a primary disease mortality factor in raccoons, gray foxes, and skunks (Roscoe 1993, Davidson et al. 1992). The epizootiology of canine distemper in raccoons in New Jersey and Florida has been characterized by outbreaks at the end of the mating season in March and with increased movements of young in September (Roscoe 1993, Hoff et al. 1974). Because of the cyclic nature of canine distemper outbreaks (4 year intervals), the wide distribution of canine distemper cases, and the low incidence of the disease between epizootic peaks in New Jersey, Roscoe (1993) proposed an enzootic status for canine distemper for raccoons that becomes epizootic when raccoon densities reach high levels. Evans (1982) found that 50 to 90 percent of raccoons and gray foxes may be incapable of producing protective levels of antibody against the canine distemper virus, implicating it as a potentially important disease mortality factor. Davidson et al. (1992) diagnosed canine distemper in 78 percent of gray foxes studied in the southeastern U.S. and found canine distemper to be more significant as a mortality factor for gray foxes than all other infectious and noninfectious diseases combined. Roscoe (1993) reported that the effects of canine distemper on raccoon populations may diminish if raccoon rabies spreads and that concurrent canine distemper and rabies epizootics may become more common. The dynamics of sympatric rabies and canine distemper are not well understood; however, rabies may compensate for deaths that would have historically occurred due to canine distemper infection. Important attributes of canine distemper include that it is not a zoonotic disease like rabies and it historically has been implicated as a virus of importance to carnivore mortality.

As an omnivore, the raccoon may play an important role in community and ecosystem interactions. In coastal ecosystems, such as Canaveral National Seashore in Florida, raccoons may function as significant seed dispersers and consumers of crustaceans, small fish, sea turtle hatchlings, small mammals, and berries (Ratnaswamy and Warren 1998). This prevalence of invertebrate prey and plant matter in coastal raccoon diets is consistent with general observations made on raccoons throughout their range. Thus, raccoons have ecological connections with many components of the coastal biological community in addition to sea turtle eggs and hatchlings (Ratnaswamy and Warren 1998). At Canaveral National Seashore, lethal removal of approximately 50 percent of the raccoon population using the nesting beach did not result in a significant reduction of nest depredation (Ratnaswamy and Warren 1998).

In Ontario, it appears that human activities and disease have had no significant impact on the survival of raccoons. Despite being subjected to trapping, hunting, collisions with vehicles, infectious diseases, and removal by animal control agencies, raccoon populations are thriving. Also, habitat deterioration, habitat destruction, and urbanization seem to have had little impact on limiting raccoon populations (Rosatte 2000). The most effective control measure is likely to be the reduction or elimination of human-created food sources (e.g., covering refuse containers, removing refuse before dusk), which support raccoons at these high densities (Prange et al 2003). With raccoon population numbers annually regulated by many different environmental factors, including habitat, food, weather, disease, predation, and humans, long-ranged assessments of the affects of raccoons on localized ecological systems is difficult. For sites where raccoon populations represent a threat to National Forest System resources, efforts must be taken annually to address those threats.

2.2.9 The Affected Area Described in the EA includes USFS Lands that Have Not Been Identified as Having a Rabid Raccoon Problem.

The affected area of this supplemental EA includes National Forest System lands that have or have the potential for a raccoon rabies outbreak to occur. ORV baits are distributed based upon vaccination zones. These vaccination zones are determined in cooperation with the involved state rabies task forces, state agencies, and/or other agencies with jurisdiction over vaccine use and application in wildlife and domestic animal species. Vaccination zones are delineated based on the most current distribution of rabies cases and the expected direction of disease spread. Therefore some, all, or none of the USFS lands identified in this supplemental EA may be involved in an ORV bait distribution program on an annual basis. Figure 1-4 in Chapter 1 shows the current anticipated ORV zone based upon recent outbreaks of the virus. The National Forest System lands included in this supplemental EA were chosen since they have the greatest possibility of being involved in the overall efforts of stopping the northward and westward spread of the rabies virus in the eastern U.S.

2.2.10 Effects of Nontarget Species Consumption of ORV Baits on Program Effectiveness

Consumption of ORV baits by nontarget species is not expected to impact program effectiveness. As described in section 1.1.4, baits are developed to attract target species. The use of target preferred baits increases the likelihood of the target species consuming the baits prior to the discovery of baits by nontarget species. Furthermore, bait distribution densities are developed to compensate for the uptake of baits by nontarget species. Baits are distributed at densities that allow raccoons the opportunity to come in contact with intact baits. It has been determined based upon the success of ORV bait disbursal programs for raccoons in other parts of the various states listed under the proposed action, with similar wildlife species composition as those found on National Forest System lands, that the distribution of 75 baits per sq km (28.96 per sq mi) would be sufficient to maintain program effectiveness.

2.3 AFFECTED ENVIRONMENT

This section presents some descriptive information on the environment of the areas that would be affected by the proposed action. Other descriptive aspects of the affected environment are included in Chapter 4 in the analysis of effects which is based on the environmental and other types of issues identified in Section 2.1.

The area of the proposed program would be expanded to additional National Forest System lands (Appendix H), excluding Wilderness Areas, located within several eastern states where raccoon rabies outbreaks currently occur or are expected to occur. The affected states include: Maine, New York, Vermont, New Hampshire, Pennsylvania, Ohio, Virginia, West Virginia, Tennessee, Kentucky, Alabama, Georgia, Florida, North Carolina, South Carolina, Massachusetts, Maryland, New Jersey, Connecticut, Rhode Island, Delaware, Indiana, Michigan, Mississippi, and Louisiana. Currently, ORV program activities (cooperative rabies surveillance activities and/or baiting programs) are conducted in many of the aforementioned states on a variety of different land classes, including some National Forest System lands. The proposed program would be part of a broader program to create zones of vaccinated target species that would then serve as barriers to cease the further advancement of raccoon rabies virus variants. The potential areas involved are extensive and may cover diverse land uses, including: cultivated agricultural lands, forests, meadows, wetlands, rangelands and pastures representing diverse wildlife habitats. Aerial distribution of ORV baits would avoid urban and suburban areas that support high human population densities, as well as lakes, rivers, and Wilderness Areas. Aerial distribution of baits would primarily target rural areas as well as known areas of habitat suitable for the target species. When aerial distribution by fixed-wing or helicopter aircraft is not practical, baits would be distributed by careful hand placement to help to minimize contact by humans, pets and other domestic animals.

Figure 1-3 in Chapter 1 shows the National Forest System lands within the states where APHIS-WS could continue and expand assistance to and participation in ORV programs under the proposed action. Figure 1-4 shows the approximate ORV bait disbursal areas anticipated for 2005 and beyond. It must be kept in mind, however, that ORV baiting activities might be needed, and might therefore be conducted, on other National Forest System lands in other areas within the involved states as part of the proposed action. The ORV bait disbursal areas are also the primary expected areas where assistance by APHIS-WS is expected to be requested to collect blood, tooth and other biological samples from target animals for monitoring and surveillance. However, monitoring or surveillance activities by APHIS-WS could also occur anywhere in the respective states where state health or other appropriate agency officials determine there is a need to insure project effectiveness. Implementation of emergency response and contingency action plans that involve localized population suppression of target species could similarly be needed anywhere in the involved states where outbreaks of the targeted rabies strain occurs. Additionally, changes in funding levels over time could create changes in ORV program activities, such as increasing or decreasing the size of the ORV barrier zone and other areas to be baited and varying the types of monitoring and surveillance and research conducted.

"Major Habitat Types" as described by Ricketts et al. (1999) encompassing the states that would be affected by ORV programs under the proposed action are: Temperate Broadleaf and Mixed Forests (AL, DE, GA, IN, KY, LA, ME, MD, MI, MS, NH, NJ, NY, NC, OH, PA, RI, SC, TN, VT, VA, WV), Temperate Coniferous Forests (AL, FL, GA, LA, MS, NC, SC), Flooded Grassland (FL), Mississippi Riverine Forests (TN, KY), and Temperate Grasslands/Savannah/Shrub (IN, LA). Appendix E shows the "ecoregions" (i.e., broad level ecosystems) that occur in the potentially affected states (Bailey 1995). Ecoregions range from humid tropical areas, southern pine, and hardwood forest areas in the Southeast, to broadleaf deciduous forest, mixed-deciduous forest and coniferous forest, and boreal forest types in the East and Northeast.

Table 2-1 shows some descriptive statistics for the eastern states involved or potentially involved in rabies management programs. The states contain over 15 million acres of National Forest System land. The percentage of federal land in each state ranges from 0.3 percent to more than 13 percent and comprises 5.2 percent of the total area of the affected or potentially affected states. Baiting federal lands, such as national forests, aids in ensuring adequate ORV coverage of affected areas and is necessary for program effectiveness.

Table 2.1: Some Descriptive Statistics of States Involved or potentially involved in the National Rabies Management Program (Data from USDC 2001).

State	Total area (1000 acres)	National Forest Land (1000 acres)	Total area owned by federal gov't. (1000 acres)	percent area in federal govt. ownership
AL	32,678	665	1,234	3.8
CT	3,135	0	14	0.5
DE	1,266	0	8	0.6
FL	34,721	1,147	3,066	8.8
GA	37,745	865	1,864	5.0
IN	23,158	196	501	2.2
KY	25,512	693	1,234	4.8
LA	28,868	604	1,159	4.0
ME	21,594	53	168	0.8
MD	6,319	0	167	2.6
MA	5,035	0	72	1.4
MI	36,492	2,857	4,079	11.2
MS	30,223	1,159	1,647	5.5
NH	5,769	725	759	13.2
NJ	4,813	0	119	2.5
NY	30,681	0	106	0.3
NC	31,403	1,244	2,356	7.5
OH	26,222	227	392	1.5
PA	28,804	513	670	2.3
RI	677	0	4	0.6
SC	19,374	613	1,107	5.7
TN	26,728	634	1,658	6.2
VT	5,937	366	372	6.3
VA	25,496	1,657	2,284	9.0
WV	15,411	1,033	1,178	7.6
Total	508,061	15,251	26,218	5.2
US	2,271,343	191,785	630,266	27.7

A number of American Indian Tribes are located in the states that are involved in the ORV program and are shown in Appendix F.

Chapter 4 contains further affected environment information with respect to target and nontarget species and T&E species.

3.0 CHAPTER 3: ALTERNATIVES

3.1 ALTERNATIVES CONSIDERED, INCLUDING THE PROPOSED ACTION

Alternative 1. No Action. This alternative would imply no involvement by APHIS-WS in rabies prevention or control on National Forest System lands within the states identified in Section 1.2. The "No Action" alternative is a procedural NEPA requirement (40 CFR 1502), is a viable and reasonable alternative that could be selected, and serves as a basis for comparison with the other alternatives. APHIS-WS could still assist with the ORV program outside of National Forest System lands. Bearing permission by the USFS, the states could conduct ORV programs on National Forest System lands without APHIS-WS assistance.

Alternative 2. Proposed Action. (preferred alternative). This alternative would involve the expanded use of federal funds by APHIS-WS to purchase V-RG ORV baits and to participate in their distribution on National Forest System lands, excluding Wilderness Areas, located within the various states listed in Section 1.2 under the authorities of the appropriate state agencies in their ongoing efforts of eliminating or stopping the forward spread of raccoon rabies in the eastern U.S. The proposed action would also include APHIS-WS assistance in monitoring and surveillance activities involving the capture and release or lethal collection of the targeted animal species on National Forest System lands to take biological samples for testing to determine the effectiveness of the ORV programs. APHIS-WS could also assist state agencies in implementing contingency plans that include the localized population reduction of the target species in areas where rabies outbreaks occur beyond ORV barriers, which may encompass National Forest System lands.

Alternative 3. Live-Capture-Vaccinate-Release Programs. This alternative would involve live capture of the target species, raccoons, on National Forest System lands followed by administration of rabies vaccines by injection and release back into the wild. This strategy has been used in certain localized areas for reducing the incidence and spread of rabies in raccoons (Brown and Rupprecht 1990; Rosatte et al. 1990, 1992, 1993) and skunks (Rosatte et al. 1990, 1992, 1993). Currently, no vaccine is specifically licensed for this type of use (CDC 2000). However, certain injectable vaccines may be used "off-label" under the direction of veterinarians to vaccinate wild animal species in certain situations (J. Mitzel, APHIS-Veterinary Services, pers. comm. 2001). This method generally results in a higher percentage of a raccoon population being vaccinated than ORV, but takes much longer to accomplish in a given area; for example, in Ontario, seven trappers working from July to October were required to trap and vaccinate 50-85 percent of the raccoons in an area less than 700 sq km (270.3 sq mi), whereas the same area could have been treated with aerially dropped ORV baits in half a day (C. MacInnes, Ontario Ministry of Natural Resources, pers. comm. 2001). With this alternative, APHIS-WS would still assist with the ORV program outside of National Forest System lands.

Alternative 4. Provide Funds to Purchase and Distribute ORV baits without Animal Specimen Collections or Lethal Removal of Animals under Contingency Plans. Under this alternative, APHIS-WS would provide resources for and assistance in National Forest System land ORV bait distribution only and would not engage in or provide funds for the collection of wild animal specimens for monitoring and project evaluation purposes or for implementation of localized lethal removal actions under state contingency plans. APHIS-WS could still assist with all aspects of the ORV program outside of National Forest System lands. The states could still conduct animal specimen collections or lethal removal of animals on National Forest System lands without APHIS-WS assistance.

3.2 ALTERNATIVES CONSIDERED, BUT NOT IN DETAIL WITH RATIONALE

3.2.1 Depopulation of Target Species.

This alternative would result in the lethal removal of raccoons (on National Forest System lands in some or all of the eastern states listed) throughout the zones where outbreaks of the rabies strain is occurring or is expected to occur. The goal would be to achieve elimination of the rabies strain by severely suppressing populations of the target animal species over broad areas so that the specific strain of rabies could not be transmitted to susceptible members of the same species. This could theoretically stop the forward advance of the disease and potentially result in elimination of the particular rabies variants as infected animals die from rabies before they could transmit it to other members of the same species.

Population reduction is often suggested as a method to control rabies in wildlife populations since the disease is density dependent (Debbie 1991). Bounty incentives, regulated hunting and trapping, ingestible poisons, and fumigation of dens have all been employed to control populations with varying levels of success. MacInnes (1998) reviewed some of the past efforts to control rabies with population reduction of carrier species and concluded that, with a couple of exceptions, most such efforts have failed. In some of the situations, it could not be determined whether an observed decline or disappearance of rabies cases was attributable to population control work or to the disease simply reaching some unexplainable geographical limitation or just dying out on its own (MacInnes 1998). Also, population control as a strategy can be questionable because the leading edges of rabies outbreaks do not necessarily coincide with the edge of the range of the principal "vectors" (e.g., raccoons), nor are they always necessarily related to the population density of such vectors (MacInnes 1998).

The greatest difficulty with population reduction as a strategy for reducing or eliminating rabies is that a high level of effort must be maintained almost indefinitely (MacInnes 1998). Population suppression can be a challenge to maintain in many situations due to immigration (of other members of the same species from surrounding populations) and compensatory reproduction (i.e., larger litters and greater percentages of females breeding following population reduction) (Clark and Fritzell 1992, Connolly and Longhurst 1975). These two factors could result in local populations recovering to their previous population level in a relatively short period of time, thus requiring a sustained and frequent suppression effort to maintain populations at the desired levels.

For these reasons, this alternative was not considered further.

3.2.2 Population Control through Birth Control.

Under this alternative, APHIS-WS would provide funds or operational assistance to implement one or more methods to control populations of the target species on National Forest System lands by reducing reproduction. Such methods could involve live capture and surgical sterilization [reviewed by Kennelly and Converse (1997)], the use of chemical reproductive inhibitors placed out in baits or delivery devices (Balser 1964, Linhart et al. 1968), or the application of *immunocontraception* strategies (i.e., vaccines that can cause infertility in treated animals).

The suppression of reproduction over time would eventually reduce the size of target species populations and lead to a reduction in the potential for the spread of the rabies by reducing the chances of contact between infected and healthy animals. However, this approach would do nothing in the immediate short term to reduce the risk of rabies spread in the existing populations, since those animals would continue to be present and capable of contracting and passing on the disease. Therefore, this type of strategy would be viewed as a longer term remedy for stopping rabies spread. It would probably not be useful in meeting the immediate needs for stopping a localized outbreak of rabies that occurs beyond designated ORV bait drop zones.

Live capture and surgical sterilization of whole local populations of animals would be extremely expensive, time-consuming, and difficult to achieve. Considerable expense would be involved in employing experienced and qualified veterinarians to perform large numbers of surgical procedures on captured animals. From a rabies control standpoint, if all or nearly all of a local population could be live captured, it would be more effective and less costly to administer rabies vaccinations by injection, which is already considered as Alternative 3.

Immunocontraception is a potentially useful concept for mammalian population suppression but is still in the early stages of research and development (Bradley 1995, Miller 1997). Genetically engineered vaccines that cause a target species to produce antibodies against its own sperm or eggs or that affect reproductive hormone functions have been produced (Miller 1997). Logistical concerns that still need to be addressed before this method could be applied successfully in the field include durability of the contraceptive vaccines in baits after distribution in the field, and the limitation of current vaccine designs that require baiting an animal population twice about one month apart to successfully treat individual wild animals (Miller 1997). Also, it is likely that a greater proportion of the population would have to be treated with contraceptive vaccines than with rabies vaccines in order to achieve effective rabies control; thus, achieving effective control would be more costly and difficult under this alternative than under ORV programs (C. MacInnes, Ontario Ministry of Natural Resources, pers. comm. 2001). Environmental concerns with this strategy that still need to be addressed include safety of the proposed genetically engineered vaccines to humans, other wildlife species, and even in nontarget members of the target species, such as juveniles that might consume baits (Miller 1997, Guynn 1997, Hanlon and Rupprecht 1997).

No contraceptive agents are currently registered for raccoons and are thus not legal for use. For all of the reasons listed above, the use of birth control to manage rabies was not considered further.

3.2.3 Employ Other Types of ORV instead of the V-RG Vaccine.

Under this alternative, APHIS-WS would provide funds to purchase and use a "modified-live-virus" (i.e., "attenuated" or weakened strain that has been shown to have little chance of causing rabies in treated animals) or perhaps "killed-virus" (i.e., "inactivated" virus) oral vaccines instead of the V-RG vaccine in ORV baits on National Forest System lands. Modified-live-virus vaccines include those that have been used in the past in the U.S. to vaccinate domestic animals by injection. Oral baits that employed several strains of these types of virus vaccines have been investigated and used in Europe to stop the spread of rabies in red foxes (Flamand et al. 1993; Artois et al. 1993, 1997). They have also been tested in red foxes in Canada (Lawson et al. 1989, 1997), and in red foxes and raccoons in the U.S. (Rupprecht et al. 1989, 1992b).

The primary concern with attenuated or "live" virus vaccines (e.g., SAD and ERA) is that they can sometimes cause rabies (Flamand et al. 1993, Pastoret et al. 1992). Flamand et al. (1993) reported that one strain used widely in oral baits in Europe to vaccinate wild red foxes in the 1970s could cause rabies in rodents when injected and that the ability to cause rabies in nontarget animals by other modes (i.e., oral administration) could not be ruled out. Previously used attenuated strains are also "heat sensitive" which can limit their use in warmer seasons or climates (Pastoret et al. 1992). These types of safety concerns with attenuated rabies virus vaccines have been sufficient to prevent their approval for use in the U.S. (Rupprecht et al. 1992b).

Inactivated or "killed" virus rabies vaccines are safer than "live" vaccines in that they cannot cause rabies. This type of vaccine was found to be less effective in causing immunity when delivered into the intestinal tract in foxes (only 30 percent effective in test animals) and took two doses to cause immunity in the foxes that were successfully immunized (Lawson et al. 1989). Also, the amounts of virus particles that would have to be ingested in oral baits by wild carnivores to effectively vaccinate them would be 100 to 1000 times the amount of the live-attenuated virus particles required (Rupprecht et al. 1992b). To manufacture vaccines with these amounts would probably be cost-prohibitive (Rupprecht et al. 1992b).

Currently, RABORAL V-RG® is the only vaccine licensed for use in raccoons (CDC 2000). For all of the above reasons, this alternative was not considered further.

3.3 MITIGATION IN STANDARD OPERATING PROCEDURES FOR RABIES ORV PROGRAMS

Mitigation measures are any features of an action that serve to prevent, reduce, or compensate for impacts that otherwise might result from that action. Because of extensive public and interagency involvement in the development of ORV programs and strategies, a number of key mitigating measures are currently part of the standard operating procedures of state-operated ORV programs. Other mitigating factors were requested by USFS personnel regarding ORV activities on National Forest System lands. These factors include:

- Notification of the USFS prior to project implementation on National Forest System lands.

- Public information and education actions and media announcements to inform the public about ORV bait distribution activities before they occur.

- Toll-free telephone numbers would be advertised in the media and on web sites for people to call for answers to questions.

- The availability of vaccinia immune globulin by the CDC to a state on a case-by-case basis, in the unlikely event that an adverse vaccinia virus exposure in humans occurs, to provide a level of additional assurance that such a reaction would be successfully treated.

- Training of bait distribution navigators to avoid dropping baits on people, structures, and large bodies of water (lakes, reservoirs, rivers). During aerial bait drop operations, the bait dispensing equipment is temporarily turned off over large bodies of water, human dwellings, and when people are observed below.

- Adherence by APHIS-WS personnel to air safety standards.

- Training of APHIS-WS personnel in hand distribution of baits to avoid properties with greater risk of human or pet encounters with baits.

- The use of off-road vehicles as necessary if hand baiting operations are deemed appropriate. All USFS closures prohibiting off-road vehicle travel would be strictly adhered to except as permitted by the appropriate USFS personnel.

- Labels are affixed to each ORV bait instructing persons not to disturb or handle them and contain a toll-free telephone number to call for further information and guidance in the event of accidental exposure to the vaccine.

- Education campaigns by state and local health departments, the CDC, APHIS-WS, Cornell and Tufts Universities, and others are already occurring in conjunction with the ORV program to educate the general public about rabies prevention and risks.

- Methods used to capture raccoons would mainly involve the use of cage traps; however, other methods such as shooting, leg hold traps, and snares may be used in some programs. Animals caught in cage traps that must be sacrificed (killed) for testing, local depopulation, or per cooperating landowner's request would be euthanized in accordance with recommendations by the American Veterinary Medical Association and APHIS-WS policy.

- Capture devices would be checked on a daily basis.

- Field personnel involved in trapping and handling animals for monitoring and surveillance purposes would be immunized against rabies and tetanus.

- All drugs used in capturing and handling raccoons and other animals would be under the direction of state or federal veterinary authorities, either directly or through procedures agreed upon between those authorities and APHIS-WS.

- Monitoring and surveillance activities may extend into the hunting season during late summer/fall ORV baiting schedules. Therefore, target species would either be marked or euthanized if capture and handling activities that utilize immobilizing drugs are used within 30 days of hunting or trapping season. These measures are taken to avoid release of animals that may be consumed by hunters prior to the end of established withdrawal periods for the particular drugs used.

- Animals that have been immobilized and released would be ear tagged or marked in some other way to alert hunters and trappers that they should contact APHIS-WS personnel before consuming the animal.

- Aerial baiting would not be conducted on any designated Wilderness Areas of National Forest System lands. APHIS-WS flight transects would be drawn around Wilderness Areas during preparation for baiting campaigns. If this is not possible, aircraft pilots would increase their altitude to 609.6 m (2000 ft) over Wilderness Areas.

4.0 CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

This section analyzes potential environmental consequences using Alternative 1 (no action) as the baseline for comparison with the other alternatives to determine if the real or potential impacts are greater, lesser or the same. Table 4-1 at the end of this chapter summarizes a comparison of the issues and impacts to each alternative.

The following resource values in the states involved in the proposed action would not be significantly impacted by any of the alternatives analyzed: soils, geology, minerals, water quality/quantity, flood plains, wetlands, visual resources, air quality, prime and unique farmlands, aquatic resources, timber, and range.

4.1 Alternative 1 -- No Action (No Involvement by APHIS-WS in Rabies Prevention or Control on National Forest System Lands)

4.1.1 Potential for Adverse Effects on People that Become Exposed to the Vaccine or the Baits.

Under this alternative, APHIS-WS would not participate in an ORV program on National Forest System lands. APHIS-WS would still purchase funds for use on other lands within the involved states in the eastern U.S. Baiting National Forest System lands is important for achieving an effective program. If baiting programs were conducted around these large land masses, reservoirs of the virus would likely still exist, creating holes in the program and potentially making the program less effective at stopping the forward advance or eliminating the raccoon strain of the rabies virus. Although unlikely, the states could seek approval to fund and conduct ORV programs on National Forest System lands to some degree without APHIS-WS assistance. They may seek other sources of federal funds to complement state funding. If this is the case, people would still have the potential to come into contact with baits or the vaccine. Actual risks of adverse effects from exposure to vaccinia virus would still be exceedingly low and insignificant.

It is conceivable that federal coordination of ORV programs would actually result in fewer numbers of ORV baits used over the years or that ORV bait use in many areas would be for shorter time periods. This is because effective federal coordination may have a better chance of stopping or even eliminating one or more of the several rabies strains from large areas than if the individual states are left to themselves to conduct ORV programs.

4.1.1.1 Potential to Cause Rabies in Humans.

The no action alternative would most likely result in greater risk of human exposure to rabies than the proposed action (Section 4.2) because reservoirs of the virus would likely still exist on National Forest System lands. In the unlikely event that states decide to fund and conduct programs on USFS lands without APHIS-WS assistance, they would have less chance of being successful in stopping or preventing the spread of the raccoon rabies variant. Therefore, an absence of APHIS-WS participation and funding on National Forest System lands could be expected to result in increased risk of human rabies cases because of expanding epizootics. The V-RG vaccine would not cause rabies under any expected scenario involving the distribution of ORV baits.

4.1.1.2 Potential for Vaccinia Virus to Cause Disease in Humans.

Under the no action alternative, V-RG oral vaccine containing the vaccinia virus vector would still be available for state-approved use in ORV programs on National Forest System lands. Such programs would probably be conducted on a lesser scale, if at all, without APHIS-WS funds and participation. The potential for vaccinia-related disease cases would be lower than under the proposed action. The likelihood that any cases would occur is extremely remote under any expected scenario involving the distribution of ORV baits.

4.1.1.3 Potential to Cause Cancer (Oncogenicity).

Under the no action alternative, V-RG oral vaccine containing the vaccinia virus vector would still be available for state-approved ORV programs on National Forest System lands, but would probably be used on less total land area, if at all, without APHIS-WS funds and participation. Because the vaccinia virus used in the V-RG vaccine is not a cancer-causing agent, expected scenarios involving the use of ORV baits by the states would not result in increased cancer risks.

Based on this information, risks to humans from contact with the V-RG vaccine are believed to be minimal with or without APHIS-WS funding or assistance. The risk and potential severity of adverse effects from rabies exposures in humans would probably be greater without ORV programs on National Forest System lands than would be the risk of serious adverse effects from vaccinia virus infections with ORV programs.

4.1.2 Potential for Adverse Effects on Target Wildlife Species Populations.

Under the no action alternative, APHIS-WS baiting programs would be conducted around the National Forest System lands located within ORV zones. Therefore, raccoons found within this land class would not be baited and would not be vaccinated against rabies. In the unlikely event that state-run programs initiated ORV programs on National Forest System lands, fewer raccoons would be vaccinated against rabies without APHIS-WS contribution to ORV bait purchases and distribution. Therefore, more animals would likely die from rabies on National Forest System lands with potentially greater short-term population impacts. Such impacts would be expected to recur as raccoon populations have strong capabilities to recover (Connolly and Longhurst 1975, Fritzell 1987, Sanderson 1987), which would establish new populations susceptible to rabies mortality. If ORV programs are not conducted on these lands, reservoirs of the virus could remain in untreated areas making the total elimination of this strain of the virus highly unlikely. Additionally, if the state ORV programs failed for lack of APHIS-WS assistance, rabies epizootics may be expected to occur that would likely result in short-term die-offs of target species over broader geographic areas.

4.1.2.1 Effects of the ORV V-RG Vaccine on Raccoons.

Under the no action alternative, states would still be able to employ the V-RG oral vaccine to combat raccoon rabies. This scenario, however, would be unlikely as states would not have APHIS-WS funding and assistance to purchase and distribute baits on National Forest System lands. As concluded in the analysis below in Section 4.2.2, the V-RG vaccine in baits would have no adverse impact on raccoon populations.

4.1.2.2 Effects of Monitoring/Surveillance or Localized Population Reduction (Contingency Actions) on Raccoon Populations in Eastern States.

Under the no action alternative, states would still be able to implement some level of monitoring, control, and contingency actions that result in localized population suppression in attempt to control rabies outbreaks. This scenario, however, would be unlikely as states would not have APHIS-WS funding and assistance to manage rabies on National Forest System lands. Thus, the numbers of raccoons killed under such programs would probably be less than if APHIS-WS funds and personnel were available. Therefore, as supported by the analysis in Section 4.2.2.2, effects on raccoon populations would be insignificant.

4.1.3 Potential for Adverse Effects on Nontarget Wildlife Species, including Threatened or Endangered Species.

4.1.3.1 Effects of the V-RG Vaccine on Nontarget Wildlife including Threatened or Endangered Species.

Under the no action alternative, there would be no potential for APHIS-WS assistance to result in adverse impacts on nontarget wildlife on National Forest Service lands because of ORV programs. This alternative could result in an increase in exposure of nontarget wildlife to the rabies virus, however. Reservoirs of the virus could remain in untreated areas making the total elimination of this strain of the virus highly unlikely. Although unlikely, state-run programs would still be able to conduct ORV programs on National Forest System lands using the V-RG vaccine. Such programs would probably be conducted on a reduced scale without APHIS-WS funding and assistance. However, based on the analysis in Section 4.2.3, there is almost no potential for adverse effects on nontarget wildlife because of ORV bait consumption under any scenario involving the distribution of baits containing the V-RG vaccine.

4.1.3.2 Effects of Capture/Removal Methods (Used in Monitoring and Surveillance or to Reduce Local Populations of Target Species under State Contingency Plans) on Nontarget Species, including Threatened or Endangered Species.

Under the no action alternative, there would be no potential for APHIS-WS assistance to result in adverse impacts on nontarget wildlife on National Forest System lands. Although unlikely, states would still be able to conduct ORV programs on National Forest System lands, including monitoring and surveillance activities that could involve the capture and/or killing of wild animals. The potential adverse effect on nontarget wildlife and T&E species from methods used in monitoring and surveillance programs would be less than the proposed action as state-run programs would not have APHIS-WS funding or assistance and would likely be conducted on a reduced scale, if at all. However, based on the analysis in Section 4.2.3, adverse effects on nontarget wildlife as a result of capture/removal methods under the proposed action alternative would be insignificant.

4.1.4 Potential for Adverse Effects on Pet Dogs or Other Domestic Animals that Might Consume the Baits.

Under the no action alternative, the potential for APHIS-WS assistance to result in adverse impacts on domestic pets or other domestic animals on National Forest System lands would be zero. Although unlikely, the states would still be able to conduct ORV programs on National Forest System lands. However, such programs would likely be conducted on a reduced scale, if at all, without APHIS-WS funding and assistance. Based on the analysis in Section 4.2.4, there is almost no potential for adverse effects on domestic animals because of ORV bait consumption under any scenario involving the distribution of baits containing the V-RG vaccine. On the other hand, failure to stop or prevent the spread of rabies would result in adverse effects on domestic animals by increasing their likelihood of exposure to rabid wild animals.

4.1.5 Potential for the Recombined V-RG Virus to "Revert to Virulence" and Result in a Virus that could Cause Disease in Humans or Animals.

Under the no action alternative, V-RG vaccine baits would not be used by APHIS-WS on National Forest System lands and, thus, the potential for the recombined V-RG virus to "revert to virulence" and result in a virus that could cause disease in humans or animals would be zero. Although unlikely, the states would still be able to conduct ORV programs on National Forest System lands. However, such programs would likely be conducted on a reduced scale, if at all, without APHIS-WS funding and assistance. As shown by the analysis in Section 4.2.5, the potential for serious environmental effects with regard to this issue is negligible under any scenario.

4.1.6 Potential for the V-RG Virus to Recombine with Other Viruses in the Wild to Form New Viruses that could Cause Disease in Humans or Animals.

Under the no action alternative, V-RG vaccine baits would not be used by APHIS-WS on National Forest System lands and, thus, the potential for the V-RG virus to recombine with other viruses in the wild to form new viruses that could cause disease in humans or animals would be zero. Although unlikely, the states would still be able to conduct ORV programs on National Forest System lands. However, such programs would likely be conducted on a reduced scale, if at all, without APHIS-WS funding and assistance. As shown by the analysis in Section 4.2.6, the potential for serious environmental effects with regard to this issue is negligible under any scenario.

4.1.7 Potential for Aerially Dropped Baits to Strike and Injure People or Domestic Animals.

Under the no action alternative, there would be no potential for APHIS-WS involvement to result in or increase this risk on National Forest System lands. Although unlikely, the states would still be able to conduct ORV programs on National Forest System lands. However, such programs would probably be conducted on a lesser scale, if at all, without APHIS-WS funding or assistance. As discussed in Section 4.2.7, the risk of persons or animals being struck by ORV baits is extremely remote.

4.1.8 Cost of Raccoon ORV Programs in Comparison to Perceived Benefits.

Under the no action alternative, APHIS-WS baiting programs would be conducted around the National Forest System lands located within ORV zones. Although unlikely, state-run programs would still be able to conduct ORV programs on National Forest System lands in the absence of APHIS-WS participation. Without APHIS-WS funding and assistance, such programs would probably be conducted on a reduced scale, if at all, and may be less successful in stopping the forward advance of rabies. Overall program costs would decline, but benefits, in terms of avoided costs (described in Section 4.2.8), would also decline with the most likely result being greatly increased state and private costs to monitor and vaccinate for rabies across large areas of the U.S. It is believed that, based on the analysis in Section 4.2.8, the increased state and private costs resulting from failure to stop the spread of the rabies variants would exceed by a substantial margin the savings in program costs that would occur by implementing the no action alternative. Thus, the benefit:cost ratio of this alternative would be expected to be much less (i.e., less desirable) than that of the proposed action.

4.1.9 Humaneness of Methods Used to Collect Wild Animal Specimens Critical for Timely Program Evaluation or to Reduce Local Populations of Target Species under State Contingency Plans.

Under the no action alternative, APHIS-WS would not assist in collecting wild animal specimens on National Forest System lands for ORV monitoring programs or for local population suppression efforts under contingency plans to address local rabies outbreaks beyond ORV barriers. Although unlikely, the states would still be able to conduct such programs on their own, although to a lesser degree without APHIS-WS funding and assistance. The primary method that would be used by APHIS-WS to capture raccoons (cage traps) would likely be the primary method used by state programs, although to a lesser degree in the absence of APHIS-WS funding and assistance. Thus, some persons would view this as being a more humane alternative because of the lower frequency of the methods used.

Failure of a successful ORV program would likely result in an increased, but varying, proportion of raccoon and other wild mammal species populations succumbing to rabies when exposed to the rabies virus. The symptoms of rabies include insomnia, anxiety, confusion, slight or partial paralysis, excitation, hallucinations, agitation, hypersalivation, difficulty swallowing, and hydrophobia (fear of water) (CDC 2001a). Some persons might argue that dying from rabies, which can take several days once symptoms appear, results in more animal suffering than being captured or killed by monitoring and surveillance activities. In any event, it is almost certain that much larger numbers of animals would succumb to rabies without effective ORV programs than would experience stress and suffering from being captured or killed by monitoring activities. The numbers dying of rabies could increase dramatically as epizootics of specific strains spread across larger areas of the U.S. With this in mind, it would appear that, on balance, the implementation of successful ORV programs that include animal collections for monitoring results in less animal suffering than taking no action.

4.2 Alternative 2 -- Proposed Action (Provide APHIS-WS funds to purchase and participate in the distribution of ORV baits on National Forest System lands in several states; assist in monitoring, surveillance and project evaluation by capturing and releasing or killing target species of carnivores for the collection of blood serum, biomarker and other biological samples; potentially assist in implementing contingency actions that include localized lethal population reduction of target species or concentrated localized ORV baiting).

4.2.1 Potential for Adverse Effects on People that Become Exposed to the Vaccine or the Baits.

Direct tests of the safety of V-RG in humans have not been conducted, for understandable reasons. Prior EAs by APHIS have analyzed in detail the potential for adverse effects on humans from V-RG exposure as a result of ORV experimental programs (USDA 1991, 1992, 2001a, 2003, 2004a).

4.2.1.1 Potential to Cause Rabies in Humans.

The nature of the recombinant virus used as the V-RG vaccine is such that it cannot cause rabies. This is because the V-RG vaccine only carries the gene for producing the outer coating of the rabies virus (i.e., rabies virus *glycoprotein*) and not those portions of the virus that could result in replication of the rabies virus which would have to happen for the disease to occur.

Implementation of the ORV program would reduce the risk of humans contracting rabies by reducing the chance of encountering rabid animals that have been infected by the raccoon variant of the disease. The proposed action would most likely result in less risk of human exposure to rabies than the no action alternative.

4.2.1.2 Potential for Vaccinia Virus to Cause Disease in Humans.

The vaccinia virus portion of the V-RG vaccine has been recognized as having the potential to cause infections in persons exposed to the vaccine, either through direct contact with the liquid or through contact with the mouth of an animal that has recently ingested the oral vaccine (USDA 1991). Because the vaccinia virus used in the V-RG vaccine is the same type of virus that was used in smallpox eradication, although more *attenuated* or weakened, persons who have been immunized against smallpox would likely not experience any adverse reaction to the vaccinia virus, but would likely experience at worst a "booster" in immunity against vaccinia virus. However, the routine administration of smallpox vaccinations was discontinued after smallpox was eradicated. Thus, a large percentage of the population (particularly younger individuals) has not been vaccinated against vaccinia. Vaccinia virus rarely poses much risk of serious health effects – even when it was *directly applied* (via "scarification" or by scratching the skin) to many hundreds of millions of people during smallpox eradication campaigns, the number that developed vaccinia virus-related illness was only a few per million. In most of those cases the extent of the illness was a mild fever and some lesions or pustules at the site of the injection, followed by full recovery and subsequent immunity to the vaccinia virus (USDA 1991, Elvinger 2001). In most people, localized lesions occurred around the site on the arm where the smallpox vaccine was applied, but this a normal and expected response and, in general, no cause for concern.

More severe complications involving the central nervous system (CNS) can occur with vaccinia virus and are generally thought to be allergic in nature (USDA 1991). CNS complications occurred at an average rate of 3 per million among persons vaccinated with vaccinia virus (e.g., to prevent smallpox) with about 10 to 30 percent of those cases resulting in death (USDA 1991). Thus, the chance of a person dying from direct application of a high dose of vaccinia virus via scarification would be about 1 in a million cases or less. With ORV baits distributed in the wild, people would run far less risk of being exposed to vaccinia virus or the V-RG vaccine in a way similar to deliberate smallpox vaccinations, but would primarily only run the risk of skin contact by handling broken baits or coming into contact with the oral regions of pets that had just consumed a bait. For that type of exposure, the chance of adverse effects from human infection with vaccinia virus would be far less than 1 in a million.

Another highly important characteristic of the V-RG vaccine is that it is weaker (more "attenuated") than the original parent vaccinia strain used in making it, and this has been proven in laboratory tests with mice (USDA 1991). This characteristic even further reduces the risk of V-RG vaccine causing vaccinia-related illness in humans. However, persons with immune system deficiencies (e.g., AIDS) run a relatively greater risk of experiencing adverse effects if directly exposed to the vaccinia virus than would persons with normal immune systems (USDA 1991, 1995a, *undated a, undated b*). Experiments in mice suggest that immune-deficient people would be at minimal risk of adverse effects when exposed to V-RG vaccine (Hanlon et al. 1997, USDA 1991). To aid in further minimizing the potential for adverse effects on humans because of contact with V-RG vaccine, each ORV bait contains a warning label advising persons who make contact with baits or the vaccine liquid to contact officials. A telephone number is provided on the bait for further guidance.

An indirect source of information on this issue is the safety record of laboratories that have worked with the V-RG vaccine (USDA 1991). Ordinarily, lab personnel working with infectious materials or animals are protected by immunization and by procedures and equipment that minimize risk. V-RG vaccine has been completely safe for humans in laboratory situations (USDA 1991). Potential non-laboratory exposure of humans in the various European field trials of V-RG vaccine has been considerable, with no program in place that monitors antibody levels of residents before and after the field trials. However, there have not been any reports of increased incidence of sickness in the field trial areas that could be attributable to the V-RG vaccine (USDA 1991; G. Moore, TX Dept. of Health, pers. comm. 2001).

Studies of the effects of V-RG vaccine on nonhuman primates can provide an indication of the potential to affect humans (USDA 1991). Studies in which squirrel monkeys (*Saimiri sciureus*) and chimpanzees (*Pan troglodytes*) were inoculated with the V-RG vaccine demonstrated that indirect human exposure to the vaccine that might occur via a bite or from contact with body fluids of a recently vaccinated animal is unlikely to produce adverse effects in healthy individuals (Rupprecht et al. 1992a, USDA 1991).

McGuill et al. (1998) conducted a retrospective 4-year survey of directors of five ORV programs using V-RG vaccine that were conducted from 1992-1996 to evaluate the potential for human health problems. The programs occurred in Florida, Massachusetts, New Jersey, New York, and Texas. Altogether, they involved a total of 109,276 sq km (42,181 sq mi) of treated area and a total of nearly 6 million baits distributed. Human contacts with the baits totaled 316, of which 53 resulted in contact with the actual vaccine liquid. The directors of all programs reported that human contact was minimal and that there were no reported adverse reactions in people exposed to the baits. Human contact with the baits was more likely in areas where bait had white labels vs. lettering in black ink, and the authors speculated the reason to be because the white labeled baits were more visible and thus more likely to be noticed. The authors concluded that, based on their survey, major concerns about public health risks from V-RG vaccine were unfounded.

Out of approximately 55.3 million baits disbursed since APHIS-WS program inception in 1995, only 801 people reported contacting or potentially contacting a bait (i.e., picking up bait, finding a bait in yard, reporting seeing a bait but not touching it, or removing bait or sachet from pet's mouth, feces, or vomit - any type of contact with a bait is also defined throughout the document as an "exposure"). This equates to one human exposure per 69,065 baits distributed (0.0013 percent contact cases). In addition, exposure cases were generally insignificant as most involved finding an intact bait. Very few cases involved touching a broken bait, sachet, or liquid vaccine. Furthermore, of the 0.0014 percent of contact cases reported since APHIS-WS ORV program inception in 1995, only one known adverse reaction has occurred (USDA 2005a, 2005b).

The adverse reaction occurred in Ohio in September, 2000, when a woman was bitten by her dog while trying to take away an ORV bait. The vaccine liquid was exposed to the bite area, resulting in localized inflammation and pox virus lesions at the site of the bite, as well as a whole body rash. She further experienced sloughing of the outer layers of skin from some portions of her body, similar to what occurs in the skin condition eczema (C. Rupprecht, CDC, pers. comm. 2001). The woman, who was in her first trimester of pregnancy, is reported to have recovered from complications and gave birth to a 10-lb. baby boy with no apparent adverse health effects (R. Krogwold, OH Dept. of Health, pers. comm. 2001). Most recent reports attribute her response to the vaccinia virus as likely due to the reduced state of immunity typical during pregnancy and an underlying skin disorder (epidermolytic hyperkeratosis) that the woman already had (C. Rupprecht, CDC, pers. comm. 2001). The woman also tested positive for rabies antibodies three weeks after the exposure, indicating she may also have developed rabies immunity (Rupprecht et al. *unpublished* 2001, Rupprecht et al. 2001). A lawsuit was filed in 2001 and a judgment was determined in favor of the defendant, the Ohio Department of Health, in May 2003. This type of incident appears to be unusual, but, nevertheless, points to the need for continued public information and education activities and field surveillance for accidental human exposure to the V-RG virus.

Although there is no approved anti-viral compound available yet for treatment of suspected vaccinia virus complications, the CDC can make vaccinia immune globulin available to the state on a case-by-case basis, with a requirement that certain specimens (such as acute and convalescent sera and swabs/scabs of the affected site) be collected for diagnosis (C. Rupprecht, CDC, pers. comm. 2001). This option provides some level of additional assurance that severe adverse effects on humans from vaccinia virus reactions would be successfully treated to avoid significant public health problems.

A recent study indicates vaccinia virus that originated from a strain used in smallpox vaccinations in Brazil may have become established in domestic cows in that country (Damaso et al. 2000). This indicates there is some potential for the use of vaccinia virus to result in a new emerging infectious disease. There is currently no evidence that this type of phenomenon has occurred in the U.S. (C. Rupprecht, CDC, pers. comm. 2001). Also, the vaccinia virus strain used for smallpox vaccination in Brazil was different than the strain that is currently used in the V-RG vaccine, and the vaccinia virus portion of V-RG is more attenuated (i.e., *weaker*) than the strains used in smallpox vaccines (USDA 1991). Thus, it is less likely that V-RG vaccine would result in the establishment and persistence of vaccinia virus in wild or domestic animals. However, no surveillance or testing of animals for this virus has been done in the U.S. to test this hypothesis (C. Rupprecht, CDC, pers. comm. 2001).

The above information shows there is some potential for unusual circumstances to result in short-term adverse health effects from exposure to the vaccinia virus in the V-RG vaccine. However, the overall risk of such effects appears to be negligible based on the extremely low rate of reported occurrences in ORV programs. The potential risk for vaccinia-related disease cases would be higher than the no action alternative. However, the likelihood that any cases would occur is extremely remote under any expected scenario involving the distribution of ORV baits.

4.2.1.3 Potential to Cause Cancer (Oncogenicity).

This issue has been addressed in a previous EA and in formal risk analyses (USDA 1991, *undated a, undated b*). Vaccinia virus is not known to be a tumor-inducing virus. There have been no documented reports of oncogenicity associated with natural vaccinia virus infections in any animal species. The recombinant DNA methods used for preparation of the V-RG vaccine do not introduce any known oncogenes (i.e., cancer-causing genes) into the vaccinia virus strain that could cause it to become tumor-inducing.

Based on this information, risks to humans from contact with the V-RG vaccine are believed to be minimal. The risk and potential severity of adverse effects from rabies exposures in humans would probably be greater without ORV programs than would be the risk of serious adverse effects from vaccinia virus infections with ORV programs.

4.2.2 Potential for Adverse Effects on Target Wildlife Species Populations.

4.2.2.1 Effects of the ORV V-RG Vaccine on Raccoons.

The primary concern here is whether the V-RG virus might cause disease in target animals that consume the ORV baits. Large numbers of raccoons have been inoculated with, or have consumed baits containing, the vaccine without ill effects, and most were successfully immunized against rabies (USDA 1991, Rupprecht et al. 1988). Tests showed that the V-RG virus did not invade the CNS or the cerebrospinal fluid of treated raccoons which indicated no adverse effects on the CNS are likely (USDA 1991, Hanlon et al. 1989b). Other tests showed that the V-RG vaccine did not cause any lesions or viremia (i.e., presence of the virus in the blood) in tissues sampled from treated raccoons (Rupprecht et al. 1988). These studies, in addition to the absence of reports of adverse effects in free-ranging wildlife in current/historical ORV program areas, have demonstrated the safety and effectiveness of the V-RG vaccine in raccoons.

ORV baits containing the V-RG vaccine would thus have no adverse impact on raccoon populations (same as no action alternative). Implementation of an ORV program would likely have a beneficial impact to raccoons by reducing the occurrence of the raccoon variant of the rabies virus in the wild. The beneficial impact to raccoon populations would be greater than the no action alternative.

4.2.2.2 Effects of Monitoring/Surveillance or Localized Population Reduction (Contingency Actions) on Raccoon Populations in Eastern States.

The estimated cumulative size (over all involved states and including National Forest System lands) of the proposed raccoon rabies ORV barrier zones to be treated with ORV baits purchased with USDA funds in any one year would be about 102,650 sq km (39,623 sq mi) (Kemere et al. 2001). Raccoon densities range from 0.9 to as high as 250 per sq km (about 2 to 650 per sq mi) with most reported densities in the range of about 4 to 30 per sq km (about 10 to 80 per sq mi) in rural areas (Riley et al. 1998). Assuming this range of densities occurs in the proposed ORV zones, it is reasonable to assume that overall raccoon numbers in those areas total between 400,000 and 3.1 million.

Raccoon populations can generally be expected to withstand harvest rates of about 49 percent or more annually (Sanderson 1987, USDA 1997). APHIS-WS and cooperating state or local agencies expect to continue to live-trap or lethally remove less than one percent of the lowest estimated number of raccoons in all states combined for monitoring and surveillance purposes or implementation of localized contingency plans involving lethal population reduction. The 2004 Monitoring Report (USDA 2005b) for the APHIS-WS EA – Oral Vaccination to Control Specific Rabies Virus Variants in Raccoons, Gray Foxes, and Coyotes in the U.S. (2004a) indicates the lowest estimated size of the raccoon population totaled from those states participating in the ORV program is 656,483 raccoons. The APHIS-WS program killed 764 raccoons for enhanced rabies surveillance as a part of cooperative ORV efforts or 0.12 percent of the total lowest estimated population in 2004. The report summarizes that the ORV program continues to have no adverse impacts to raccoon densities and that, in the absence of the ORV program, it is highly likely that far more raccoons would die from rabies than are killed for surveillance and monitoring purposes to critically evaluate the integrity of ORV campaigns.

The majority of raccoons captured for monitoring or surveillance purposes would be released at their site of live capture once they have fully recovered from anesthesia. Individual raccoons may be lethally removed and tested for rabies if they are demonstrating strange behavior symptomatic of the rabies virus or are injured. An exception may be when the animals are captured and drugged for handling purposes close to or during hunting/trapping seasons, at which times they may be euthanized to avoid concerns about hunters or trappers consuming raccoons that contain drug residues (see Section 2.2.1). Contingency actions may be considered that could result in lethal raccoon population suppression in small areas in attempt to contain an outbreak that could occur beyond an existing ORV zone. Given that hunter and trapper harvest and other sources of mortality would occur, there are no anticipated significant cumulative impacts to raccoon populations even if contingency actions would be infrequently conducted in small areas of the states involved in ORV programs. Thus, the potential for adverse effects of monitoring and surveillance or localized population reduction on raccoon populations can be considered slightly higher than the no action alternative, but still negligible.

4.2.3 Potential for Adverse Effects on Nontarget Wildlife Species, including Threatened or Endangered Species.

4.2.3.1 Effects of the RABORAL V-RG® Vaccine on Nontarget Wildlife including Threatened or Endangered Species.

The primary concern here is whether the vaccinia virus-rabies glycoprotein combination (i.e., RABORAL V-RG® vaccine) might cause disease in nontarget animals that consume or otherwise come into contact with the vaccine in baits. Rupprecht et al. (1992a) and Pastoret et al. (1995) summarized the results of V-RG safety trials in nontarget species. More than 50 species from Europe and North America have been tested and include relevant taxonomic groups believed to be potentially at risk for contact with the V-RG vaccine such as:

- Natural ecological competitors of raccoons and foxes, such as the opossum (*Dedelphis virginianus*), several mustelids [skunk, badger, mink (*Mustela vision*), otter (*Lutra canadensis*), ferret (*Mustela putorius*)], other members of the Canid family [coyote, red fox, gray fox, arctic fox (*Alopex lagopus*), raccoon dog (*Nyctereutes procyonoides*)], bobcat (*Lynx rufus*), and black bear (*Ursus americanus*).

- Domestic cats (*Felix domesticus*) and dogs (*Canis familiaris*).

- 19 rodent species (Order *Rodentia*) that might be expected to gnaw on or consume baits. Families within this order represented in the studies included: *Muridae, Erethizonidae* [porcupine (*Erithizon dorsatum*)], *Sciuridae, Cricetidae,* and *Zapodidae.*

- 1 bat species [Daubenton's bat (*Myotis daubentoni*)].

- 8 bird species, including three hawk species [red-tailed hawk (*Buteo jamaicensis*), kestrel (*Falco tinnunculus*), common buzzard (*B. Buteo*)], and one species each of owl [great horned owl (*Bubo virginianus*)], crow [carrion crow (*Corvus corone*)], gull [ring-billed gull (*Larus delawarensis*)], magpie (*Pica pica*), and jay (*Garrulus glandarius*).

- Domestic livestock [cattle (*Bos taurus*), sheep (*Ovis ovis*)].

- Two wild ungulate species [wild boar (*Sus scrofa*), white-tailed deer (*Odocoileus virginianus*)].

- Two primate species (squirrel monkey and chimpanzee).

Rupprecht et al. (1992a) reported there has been no mortality or morbidity (i.e., signs or symptoms of disease) and no lesions typical of pox virus infections caused by V-RG vaccine in over 350 individual animals representing some 20 taxonomic families of animals. They concluded that the extensive laboratory safety experiments showed V-RG to be safe in all species tested to date. In field trials with V-RG ORV baits to treat wild raccoons in which target and nontarget species were captured and tested, no vaccine-related lesions or other adverse effects have been found to occur (Rupprecht et al. 1992a). The ORV program may, instead, actually reduce the likelihood of wildlife being exposed to the rabies virus. In addition, the Texas Department of Health (2003) concluded in their 2002 Texas Gray Fox After Action Report that none of the 47 nontarget species [23 coyotes, 12 skunks (*Mephitis mephitis* and *Spilogale putorius*), 8 raccoons, 3 bobcats (*Felis rufus*), and 1 red fox (*Vulpes vulpes*)], captured within the vaccination zones exhibited lesions attributable to the vaccine. Other nontargets observed during monitoring and surveillance activities within the vaccination zone had no indication of adverse reactions to the ORV baits.

There is no evidence of potential harm to target or nontarget species from overdosage of RABORAL V-RG® vaccine by any route or from multiple doses. A number of nontarget species have been dosed with 2 to 10 times the amount of vaccine in an individual ORV bait without adverse effects (USDA 1991, Rupprecht et al. 1992a). Therefore, even if domestic animals received multiple doses of vaccine by consuming multiple baits, no adverse effects would be expected to occur.

The RABORAL V-RG® vaccine would not adversely affect any non-warm blooded animal species. The vaccinia virus and other orthopoxviruses do not replicate or reproduce themselves in non-warm blooded species (Rupprecht, CDC, pers. comm. 2002). Therefore, ORV is not expected to cause any adverse effects on fish, reptiles, amphibians, or any invertebrate species should any members of these species groups consume or otherwise be exposed to the vaccine.

The RABORAL V-RG® vaccine distributed in baits would have no adverse effects on any state or federally listed threatened or endangered species or their critical habitats (see Appendices C and D for species lists) and USFS Regional Forester Sensitive Species (Regions 8 and 9) (see Appendix I). Few listed species would likely be attracted to the ORV baits, and the few carnivore species that might consume baits would be expected to experience no effect other than possibly becoming immunized against rabies.

Thus, beneficial effects of the vaccine on nontarget species would be greater than the no action alternative. Based on the above analysis, there is almost no potential for adverse effects on nontarget wildlife because of ORV bait consumption (same as no action alternative).

4.2.3.2 Effects of Capture/Removal Methods (Used in Monitoring and Surveillance or to Reduce Local Populations of Target Species under State Contingency Plans) on Nontarget Species, including Threatened or Endangered species.

The methods proposed for use in raccoon rabies monitoring and surveillance areas or in implementing localized population reduction under state contingency actions would have no significant adverse effects on nontarget species. Nontarget animals captured in cage traps would normally be released unharmed unless lethal removal was requested by the cooperating landowner or if the animal appeared injured or sick. Therefore, monitoring and surveillance should have no effect on nontarget species populations.

The 2004 Monitoring Report (USDA 2005b) for the APHIS-WS EA – Oral Vaccination to Control Specific Rabies Virus Variants in Raccoons, Gray Foxes, and Coyotes in the U.S. (2004a) indicates that nontarget populations were not adversely affected by APHIS-WS actions in 2004. Occasionally, nontarget wildlife species were captured during ORV monitoring and surveillance efforts. A total of 2,446 nontargets were captured during the 2004 ORV program (USDA 2005b). Most species were captured in cage traps and released unharmed (2,119 total in 2004). Some nontarget animals were lethally removed (347 or 16.4% of total nontarget captures in 2004), mainly if they were demonstrating strange behavior consistent with symptoms of rabies, were injured, were killed intentionally to address damage reported by the cooperating landowners at their request, or were euthanized for rabies testing. The nontargets killed (254 opossums, 13 striped skunks, 47 woodchucks, 9 feral cats, 6 nine-banded armadillos, 6 gray foxes, 2 red foxes, 2 bobcats, 3 red squirrels, 1 gray squirrel, 1 eastern cottontail, 1coyote, 1 mountain lion, 1 gray catbird, and 1 ruffed grouse) were not considered to be from low density populations and removal was not expected to have any cumulative adverse effects on populations in the area (USDA 2005a, 2005c).

No T&E species have been adversely affected by APHIS-WS actions during the course of the ORV program. In 2001, one state-endangered river otter (*Lutra canadensis*) was incidentally captured in a cage trap during Ohio ORV surveillance activities, but was released unharmed in accordance with the direction of the Ohio Division of Wildlife. APHIS-WS concluded in the monitoring report (USDA 2005b) that the cumulative impact on nontarget species is negligible and that APHIS-WS has not adversely affected the viability of any wildlife species populations. A total of two American alligators (*Alligator mississippiensis*) were incidentally captured in Florida during the 2003 and 2004 ORV programs; however, they were both released unharmed. The American alligator is federally listed as threatened due to similarity of appearance [50 CFR 17.42(a)] and state-listed as a species of concern in Florida. The federal designation regulates commercial sale and trade of alligator skins and other products. Because the animal was released unharmed, APHIS-WS did not violate the "similarity of appearance" designation. Again, APHIS-WS stated in the monitoring report (USDA 2005b) that the determination of no adverse affect is still valid for the proposed action. The report concluded that the cumulative impact on nontarget species is negligible and that APHIS-WS had not adversely affected the viability of any wildlife species populations.

APHIS-WS reviewed lists of federal and state T& E species (Appendices C and D) and USFS Regional Forester Sensitive Species (Regions 8 and 9) (Appendix I) to determine if any species might be affected. ORV programs or the methods used in capture/removal of target species in monitoring activities or contingency plan implementation would have no effect on any listed bird, reptile, amphibian, fish, invertebrate, or plant species. The only species on the federal or state T&E or special status lists that might be expected to raise concerns about potential effects from the proposed action are:

Federally Listed T&E Species (USDI 2005):

- **Canada Lynx** (*Lynx canadensis*). This species is federally designated as threatened in Maine. The USFWS has documentation that lynx occur and are reproducing in Maine and, therefore, believes that lynx could possibly disperse to contiguous suitable habitat in New Hampshire, but consider lynx occurrence as rare in New Hampshire based on recent records (USDI 2000). Furthermore, the USFWS considers it possible that lynx have been extirpated from New Hampshire, Vermont and New York (USDI 2000). The USFWS has concluded that, in the Northeast, a population of lynx most likely continues to exist in the core region of western Maine, northern New Hampshire, southeastern Quebec, and western New Brunswick; however, the range appears to have retracted northward (USDI 2000). Based on a review of past capture records, APHIS-WS has determined there to be no risk to lynx from ORV programs, from rabies monitoring or surveillance (including the capture and testing of raccoons) or other current APHIS-WS activities in these states (USDA 2000). Also, lynx are not expected to be attracted to or to consume ORV baits and would thus not be affected by them. Therefore, APHIS-WS has determined that the proposed action would have no effect on this species. A potential beneficial indirect impact of ORV programs on lynx conservation would be a reduced risk of contracting and dying of rabies if the spread of raccoon rabies is successfully halted or if the variant strain is eliminated.

- **Eastern Puma** (*Puma concolor couguar*). This species is federally designated as endangered in its entire historical range (Connecticut, District of Columbia, Delaware, Illinois, Indiana, Kentucky, Massachusetts, Maryland, Maine, Michigan, North Carolina, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Virginia, Vermont, and West Virginia). The Eastern puma was presumed extinct in wild; however, some sightings have been reported in Minnesota and Michigan recently. These individuals are believed to have originated from around New Brunswick or Manitoba, Canada (per http://endangered.fws.gov/). In addition, a number of sightings have been reported in the Southeast Region, but the best evidence for a small permanent population has come from the Great Smoky Mountain National Park Region. Sightings have also been reported in three other North Carolina areas including the Nantahala National Forest, the northern portion of the Uwharrie National Forest, and the State's southeastern counties. The remaining population of this species is extremely small and exact numbers are unknown. This species is not expected to be attracted to or to consume ORV baits. Also, animals the size of cougars would not be affected by cage-traps used to collect raccoons for monitoring purposes. Therefore, ORV programs, including monitoring activities involving the live-capture or lethal removal of raccoons, would have no effect on this species. A potential beneficial indirect impact of ORV programs on this species would be a reduced risk of contracting and dying of rabies if the spread of raccoon rabies is successfully halted or if the variant strain is eliminated.

- **Florida Panther** (*Puma concolor coryi*). This subspecies of cougar occurs in Florida and is federally designated as endangered. Florida panthers are not expected to be attracted to or consume ORV baits and would thus not be affected by them. Also, animals the size of cougars would not be affected by cage-traps used to capture raccoons for monitoring purposes. Therefore, ORV programs, including monitoring activities involving the live-capture or lethal removal of raccoons, would have no effect on this species. A potential beneficial indirect impact of ORV programs on this species would be a reduced risk of contracting and dying of rabies if the spread of raccoon rabies is successfully halted or if the variant strain is eliminated.

- **Gray wolf** (*Canis lupus*). **Eastern Distinct Population Segment (DPS) of the gray wolf.** On April 1, 2003, this segment of the gray wolf population was reclassified as federally threatened (previously considered endangered under the ESA). The eastern gray wolf DPS encompasses the historical range of the gray wolf from the Great Plains to the Atlantic Coast. Due to successful gray wolf recovery in Minnesota, Wisconsin, and Michigan, this DPS is now classified as Threatened. Animals the size of wolves would not be affected by cage traps used to capture raccoons for monitoring purposes. The small size of the cage traps, trap placement, bait type, and prebaiting techniques used for monitoring and surveillance activities should preclude the capture of these species. A potential beneficial indirect impact of ORV programs would be a reduced risk of contracting and dying of rabies if the spread of raccoon, coyote, and gray fox rabies is successfully halted or if the raccoon variant strain is eliminated.

- **Red wolf** (*Canis rufus*). The historic range of the red wolf occurred throughout the southeastern U.S. from the Atlantic Coast to central Texas and from the Gulf of Mexico to central Missouri. Red wolves are federally listed as endangered in Florida, North Carolina and South Carolina. However, red wolves are now considered to be extinct in the wild except for experimental populations in Tennessee and North Carolina. Currently 16 wolves are located in the Great Smokey Mountains National Park in Tennessee. No red wolves are currently known or believed to exist outside this park. Therefore, ORV bait distribution would have no effect on this species.

- **Louisiana Black Bear** (*Ursus americanus luteolus*). This species is listed as federally threatened in Louisiana, Mississippi, and Texas. It is conceivable that this species could consume ORV baits intended for raccoons. Safety studies on black bears (Rupprecht et al. 1992a) indicate bears would not be adversely affected by ORV. An indirect beneficial effect would be a reduced risk of the species suffering further declines because of a rabies epizootic. Therefore, the proposed action should have no significant impact on this species.

- **American Black Bear** (*Ursus americanus*). This species is federally listed as threatened due to similarity of appearance (T-S/A) to the Louisiana black bear in Louisiana, Mississippi, and Texas. It is conceivable that this species could consume ORV baits intended for raccoons. Safety studies on black bears (Rupprecht et al. 1992a) indicate bears would not be adversely affected by ORV. If a black bear cub was inadvertently captured in a cage trap set for a raccoon, it would be released unharmed and reported to the appropriate wildlife agencies. Therefore, the proposed action should have no significant impact on this species.

- **Delmarva Fox Squirrel** (*Sciurus niger cinereus*). This species is federally listed as endangered in Delaware, Maryland, and Virginia. It is conceivable that this species could consume ORV baits intended for raccoons. Although not specifically tested for safety in this species, safety studies on other closely related rodent species (Rupprecht et al. 1992a) indicate fox squirrels would not be adversely affected. Also, an indirect beneficial effect would be a reduced risk of the species suffering further declines because of a rabies epizootic. If a Delmarva fox squirrel was inadvertently captured in a cage trap set for a raccoon, it would be released unharmed to avoid lethal take and reported to the appropriate wildlife agency. Therefore, the proposed action should have no significant impact on this species.

- **American Alligator** (*Alligator mississippiensis*). This species was delisted in 1987 and reclassified as threatened due to similarity of appearance (T-S/A) to other species such as crocodiles. This federal designation regulates commercial sale and trade of alligator skins and other products. The T-S/A designation was issued for the entire range of the alligator, including Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, and Texas. Two alligators were captured in cage traps in Florida during rabies monitoring and surveillance (one each in 2003 and 2004). They were released unharmed per the appropriate Florida wildlife agency. If alligators are captured incidentally in future ORV programs, they would also be released unharmed and reported to the appropriate state wildlife agency. By following these measures, APHIS-WS should avoid any lethal take of and adverse impact to these species.

- **American Crocodile** (*Crocodylus acutus*). This species is federally listed as endangered in Florida. The crocodile would not be attracted to ORV baits; however, although highly unlikely, a crocodile could conceivably be captured in a cage trap set for surveillance and monitoring of target raccoon species. If a crocodile was inadvertently captured in a cage trap, it would be released unharmed to avoid lethal take and reported to the appropriate wildlife agencies. Therefore, the proposed action should have no significant impact on this species.

State listed species:

- **Canada Lynx** (*Lynx canadensis*). This species is state-listed as endangered in Michigan, New Hampshire, and Vermont, and threatened in New York. This species was discussed in detail in the Federally Listed T&E Species section.

- **Bobcat** (*Lynx rufus*). The bobcat is state-listed as endangered in Ohio, Indiana, and New Jersey; threatened in Rhode Island; and "in need of conservation" in Maryland. ORV baits distributed for raccoons would not adversely affect this species (Rupprecht et al. 1992a). It is considered highly unlikely that bobcats would be caught in cage traps set for raccoons during monitoring or local population suppression activities. However, if a bobcat is caught unintentionally, it would be released unharmed to avoid lethal take and reported to the appropriate state wildlife agencies. An indirect beneficial effect would be a reduced risk of this species suffering further declines in the state because of a rabies epizootic.

- **Eastern Puma** (*Puma concolor couguar*). This species is state-listed as endangered in Georgia, Michigan, New York, North Carolina, Vermont, and Virginia, and a "species of concern" in Connecticut. This species was discussed in detail in the Federally Listed T&E Species section.

- **Florida Panther** (*Puma concolor coryi*). This species is state-listed as endangered in Florida, Georgia, Mississippi, and Louisiana. This species was discussed in detail in the Federally Listed T&E Species section.

- **Gray Wolf** (*Canis lupus*). This species is state-listed as endangered in New York, Texas, and Virginia, threatened in Michigan, and a "species of concern" in Connecticut. This species was discussed in detail in the Federally Listed T&E Species section.

- **Red Wolf** (*Canis rufus*). This species is state-listed as endangered in Louisiana. This species was discussed in detail in the Federally Listed T&E Species section.

- **American Black Bear** (*Ursus americanus*). This species is state-listed as endangered in Mississippi and Ohio, and a "species of concern" in Kentucky and South Carolina. This species was discussed in detail in the Federally Listed T&E Species section.

- **Louisiana Black Bear** (*Ursus americanus luteolus*). This species is state-listed as endangered in Mississippi and threatened in Louisiana. This species was discussed in detail in the Federally Listed T&E Species section.

- **Florida Black Bear** (*Ursus americanus floridanus*). This species is state-listed as threatened in Florida. It is conceivable that this species could consume ORV baits intended for raccoons. Safety studies on black bears (Rupprecht et al. 1992a) indicate bears would not be adversely affected if they were to consume ORV baits. An indirect beneficial effect would be a reduced risk of the species suffering further declines because of a rabies epizootic. If a black bear was inadvertently captured in a cage trap set for a raccoon, it would be released unharmed to avoid lethal take and reported to the appropriate wildlife agency. Therefore, the proposed action should have no significant impact on this species.

- **Delmarva Fox Squirrel** (*Sciurus niger cinereus*), **Sherman's Fox Squirrel** (*Sciurus niger shermani*), **Big Cypress Fox Squirrel** (*Sciurus niger avicennia*), and Eastern Fox Squirrel (*Sciurus niger*). The Delmarva fox squirrel is state-listed as endangered in Pennsylvania, Maryland, Virginia, and Delaware. The Sherman's fox squirrel is state-listed as a "species of concern" in Florida. The Big Cypress fox squirrel is state-listed as threatened in Florida. The eastern fox squirrel is state-listed as a "species of concern" in South Carolina. Although not specifically tested for safety in these species, safety studies on other closely related rodent species (Rupprecht et al. 1992a) indicate fox squirrels would not be adversely affected if they were to consume ORV baits. Also, an indirect beneficial effect would be a reduced risk of the species suffering further declines because of a rabies epizootic. If a fox squirrel was inadvertently captured in a cage trap set for a raccoon, it would be released unharmed to avoid lethal take and reported to the appropriate wildlife agency. Therefore, the proposed action should have no significant impact on this species.

- **Virginia Northern Flying Squirrel** (*Glaucomys sabrinus fuscus*), **West Virginia Northern Flying Squirrel** (*Glaucomys sabrinus fuscus*), **and Carolina Northern Flying Squirrel** (*Glaucomys sabrinus coloratus*). The Virginia northern flying squirrel is state-listed as endangered in Virginia. The West Virginia northern flying squirrel is state-listed as a "species of concern" in West Virginia. The Carolina northern flying squirrel is state-listed as endangered in Tennessee and North Carolina. Although not specifically tested for safety in this species, safety studies on other closely related rodent species (Rupprecht et al. 1992a) indicate flying squirrels would not be adversely affected if they were to consume ORV baits. Also, an indirect beneficial effect would be a reduced risk of the species suffering further declines because of a rabies epizootic. If a flying squirrel was inadvertently captured in a cage trap set for a raccoon, it would be released unharmed to avoid lethal take and reported to the appropriate state wildlife agency. Therefore, the proposed action should have no significant impact on this species.

- **North American Porcupine** (*Erethizon dorsatum*). This species is state-listed as "in need of management" in Maryland. Although not specifically tested for safety in this species, safety studies on other closely related rodent species (Rupprecht et al. 1992a) indicate this species would not be adversely affected if they were to consume ORV baits. Also, an indirect beneficial effect would be a reduced risk of the species suffering further declines because of a rabies epizootic. If a porcupine was inadvertently captured in a cage trap set for a raccoon, it would be released unharmed to avoid lethal take and reported to the appropriate state wildlife agency. Therefore, the proposed action should have no significant impact on this species.

- **American Marten** (*Martus americana*). This species is state-listed as threatened in New Hampshire and endangered in Vermont. It is conceivable that this species could consume ORV baits intended for raccoons. Although not specifically tested for safety in this species, safety studies on other closely related Mustelid species (e.g., skunk, mink, badger, ferret, and otter) (Rupprecht et al. 1992a) indicate martens would not be adversely affected if they were to consume ORV baits. Also, an indirect beneficial effect would be a reduced risk of the species suffering further declines because of a rabies epizootic. If a pine marten was inadvertently captured in a cage trap set for a raccoon, it would be released unharmed to avoid lethal take and reported to the appropriate state wildlife agency to complement their population monitoring data for this state-listed species. Therefore, the proposed action should have no significant impact on this species.

- **Everglades Mink** (*Mustela vison evergladensis*). This species is state-listed as threatened in Florida. It is conceivable that this species could consume ORV baits intended for raccoons; however, populations of this species inhabit the Everglades in southern Florida and ORV program activities are not proposed for that portion of the state. Safety studies on Mustelid species (Rupprecht et al. 1992a) indicate the mink would not be adversely affected if they were to consume ORV baits. Also, an indirect beneficial effect would be a reduced risk of the species suffering further declines because of a rabies epizootic. If a least weasel was inadvertently captured in a cage trap set for a raccoon, it would be released unharmed to avoid lethal take and reported to the appropriate state wildlife agency. Therefore, the proposed action should have no significant impact on this species.

- **Least Weasel** (*Mustela nivalis*). This species is state-listed as a "species of concern" in Kentucky and Indiana and "in need of management" in Maryland. It is conceivable that this species could consume ORV baits intended for raccoons. Although not specifically tested for safety in this species, safety studies on other closely related Mustelid species (e.g., skunk, mink, badger, ferret, and otter) (Rupprecht et al. 1992a) indicate weasels would not be adversely affected if they were to consume ORV baits. Also, an indirect beneficial effect would be a reduced risk of the species suffering further declines because of a rabies epizootic. If a least weasel was inadvertently captured in a cage trap set for a raccoon, it would be released unharmed to avoid lethal take and reported to the appropriate state wildlife agency to complement their population monitoring data for this state listed species. Therefore, the proposed action should have no significant impact on this species.

- **Long-tailed Weasel** (*Mustela frenata*). This species is state-listed as "nongame species regulation" in Alabama. It is conceivable that this species could consume ORV baits intended for raccoons. Although not specifically tested for safety in this species, safety studies on other closely related Mustelid species (e.g., skunk, mink, badger, ferret, and otter) (Rupprecht et al. 1992a) indicate weasels would not be adversely affected if they were to consume ORV baits. Also, an indirect beneficial effect would be a reduced risk of the species suffering further declines because of a rabies epizootic. If a long-tailed weasel was inadvertently captured in a cage trap set for a raccoon, it would be released unharmed to avoid lethal take and reported to the appropriate state wildlife agency to complement their population monitoring data for this state listed species. Therefore, the proposed action should have no significant impact on this species.

- **American Badger** (*Taxidea taxus*). This species is state-listed as a "species of concern" in Ohio and Indiana. It is conceivable that this species could consume ORV baits intended for raccoons. Safety studies on badgers and other mustelids (Rupprecht et al. 1992a) indicate this species would not be adversely affected if they were to consume ORV baits. An indirect beneficial effect of ORV would be a reduced risk of the species suffering further declines because of a rabies epizootic. If an American badger was inadvertently captured in a cage trap set for a raccoon, it would be released unharmed to avoid lethal take and reported to the appropriate state wildlife agency. Therefore, the proposed action should have no significant impact on this species.

- **Ermine** (*Mustela erminea*). This species is state-listed as a "species of concern" in Ohio. Although not specifically tested for safety in this species, safety studies on other closely related Mustelid species (e.g., skunk, mink, badger, ferret, and otter) (Rupprecht et al. 1992a) indicate ermines would not be adversely affected if they were to consume ORV baits. An indirect beneficial effect of ORV would be a reduced risk of the species suffering further declines because of a rabies epizootic. If an ermine was inadvertently captured in a cage trap set for a raccoon, it would be released unharmed to avoid lethal take and reported to the appropriate state wildlife agency. Therefore, the proposed action should have no significant impact on this species.

- **Round-tailed Muskrat** (*Neofiber alleni*). This species is state-listed as threatened in Georgia. It is conceivable that this species could consume ORV baits intended for raccoons. Although not specifically tested for safety in this species, safety studies on other closely related rodents (Rupprecht et al. 1992a) indicate muskrats would not be adversely affected if they were to consume ORV baits. An indirect beneficial effect of ORV would be a reduced risk of the species suffering further declines because of a rabies epizootic. If a round-tailed muskrat was inadvertently captured in a cage trap set for a raccoon, it would be released unharmed to avoid lethal take and reported to the appropriate state wildlife agency. Therefore, the proposed action should have no significant impact on this species.

- **Eastern Spotted Skunk** (*Spilogale putorius*). This species is state-listed as a "species of concern" in Kentucky, South Carolina, and West Virginia. It is conceivable that this species could consume ORV baits intended for raccoons. Safety studies on skunks (Rupprecht et al. 1992a) indicate this species would not be adversely affected if they were to consume ORV baits. Also, an indirect beneficial effect would be a reduced risk of the species suffering further declines because of a rabies epizootic. If a spotted skunk was inadvertently captured in a cage trap set for a raccoon, it would be released unharmed to avoid lethal take and reported to the appropriate state wildlife agency. Therefore, the proposed action should have no significant impact on this species.

- **Northern River Otter** (*Lutra canadensis*). The river otter is state-listed as endangered in Indiana and a "species of concern" in Virginia. ORV baits distributed for raccoons would not adversely affect this species (Rupprecht et al. 1992a). It is considered highly unlikely that river otters would be caught in cage traps set for raccoons during monitoring or local population suppression activities, although one river otter was captured and released unharmed in FY 2001. The APHIS-WS program in Ohio has a scientific collecting permit from the Ohio Department of Natural Resources, Division of Wildlife (ODOW). The ODOW has advised APHIS-WS to release any nontargets captured. If any other captures occurred they would also be released unharmed and reported to the appropriate state wildlife agency. By following these measures, APHIS-WS should avoid any lethal take of river otters. An indirect beneficial effect would be a reduced risk of this species suffering further declines in the state because of a rabies epizootic.

- **Snowshoe Hare** (*Lepus americanus*). This species is state-listed as endangered in Virginia and Ohio. The snowshoe hare has recently been reintroduced into Ohio (A. Montoney, APHIS-WS, pers. comm. 2001). Hares would not likely be attracted to or consume ORV baits. Therefore, ORV should have no effect on this species. It is highly unlikely that any snowshoe hares would be captured incidentally during rabies monitoring or local raccoon population suppression activities. If any captures occurred they would be released unharmed and reported to the appropriate state wildlife agency. By following these measures, APHIS-WS should avoid any lethal take of this species. Also, an indirect beneficial effect would be a reduced risk of this species suffering further declines in the state because of a rabies epizootic.

- **New England Cottontail** (*Sylvilagus transitionalis*). This species is state-listed as "in need of conservation" in Maryland and a "species of concern" in New York, South Carolina, and Vermont. Although unlikely, a rabbit could conceivably be captured in a cage trap set for raccoons. Any New England cottontails caught would be released unharmed and reported to the appropriate state wildlife agency, which would avoid any significant impacts on the species. Also, an indirect beneficial effect would be a reduced risk of the species contracting and dying of rabies.

- **Appalachian Cottontail** (*Sylvilagus obscurus*). This species is state-listed as a "species of concern" in West Virginia. Cottontails would not likely be attracted to or consume ORV baits. Therefore, ORV should have no effect on this species. Although unlikely, this species could conceivably be captured in a cage trap set for raccoons. Any Appalachian cottontails caught would be released unharmed and reported to the appropriate state wildlife agency. By following these measures, APHIS-WS should avoid any lethal take of this species. Also, an indirect beneficial effect would be a reduced risk of this species suffering further declines in the state because of a rabies epizootic.

- **Marsh Rabbit** (*Sylvialagus palustris*) and **Lower Keys Marsh Rabbit** (*Sylvilagus palustris hefneri*). The marsh rabbit is state-listed as a "species of concern" in Virginia. The Lower Keys marsh rabbit is state-listed as endangered in Florida. Rabbits would not likely be attracted to or consume ORV baits. Therefore, ORV should have no effect on this species. Although unlikely, a rabbit could conceivably be captured in a cage trap set for raccoons. Any marsh rabbits caught would be released unharmed and reported to the appropriate state wildlife agency, which would avoid any significant impacts on the species. Also, an indirect beneficial effect would be a reduced risk of the species contracting and dying of rabies.

- **Swamp Rabbit** (*Sylvilagus aquaticus*). The swamp rabbit is state-listed as a "species of concern" in South Carolina. Rabbits would not likely be attracted to or consume ORV baits. Therefore, ORV should have no effect on this species. Although unlikely, a rabbit could conceivably be captured in a cage trap set for raccoons. Any marsh rabbits caught would be released unharmed and reported to the appropriate state wildlife agency, which would avoid any significant impacts on the species. Also, an indirect beneficial effect would be a reduced risk of the species contracting and dying of rabies.

The proposed action would have no effect on any of the other listed species in the National Forests involved in the proposed action (see Appendices C and D).

The proposed action would have no effect on any of the other listed species in the states involved in the proposed action (see Appendices C and D).

Regional Forester Sensitive Species (USDA-Forest Service listing) Region 9, Eastern Region:

- **River Otter** (*Lutra canadensis*). This species is designated as Regional Forester Sensitive in Wayne National Forest in Ohio.

- **Bobcat** (*Lynx rufus*). This species is designated as Regional Forester Sensitive in Wayne National Forest in Ohio.

- **American Marten** (*Martus Americana*). This species is designated as extirpated from Allegheny National Forest in Pennsylvania and Green Mountain National Forest in Vermont.

- **American Black Bear** (*Ursus americanus*). This species is designated as Regional Forester Sensitive in Wayne National Forest in Ohio.

- **American Badger** (*Taxidea taxus*). This species is designated as Regional Forester Sensitive in Hoosier National Forest in Indiana.

The aforementioned species were previously discussed in the federal or state listed species sections. The proposed action would have no effect on any of these or other listed species on the national forests located within the ORV zone (see Appendix I for additional information).

Regional Forester Sensitive Species (USDA-Forest Service listing) Region 8, Southern Region:

- **Florida Black Bear** (*Ursus americanus floridanus*). This species is designated as Regional Forester Sensitive in National Forests in Alabama and Florida.

- **Round-tailed Muskrat** (*Neofiber alleni*). This species is designated as Regional Forester Sensitive in National Forests in Florida.

- **Sherman's Fox Squirrel** (*Sciurus niger shermani*). This species is designated as Regional Forester Sensitive in national forests in Florida.

The aforementioned species were previously discussed in the federal or state listed species sections. The proposed action would have no effect on any of these or other listed species on the national forests located within the ORV zone (see Appendix I for additional information).

Under the proposed action, the potential effect on nontarget wildlife and T&E species from methods used in monitoring and surveillance programs would be slightly higher than the no action alternative; however, effects of the proposed action would be negligible.

4.2.4 Potential for Adverse Effects on Pet Dogs or Other Domestic Animals that Might Consume the Baits.

Rupprecht et al. (1992a) and Pastoret et al. (1995) summarized the results of V-RG safety trials in nontarget species. The studies included oral vaccination of domestic dogs, cats, cattle, and sheep and found no adverse effects on those species. More than 55.3 million ORV baits using the RABORAL V-RG® vaccine have been distributed in the U.S. thus far with no reported adverse effects on domestic animals. There is no evidence of potential harm to target or nontarget species, including domestic dogs, cats, cattle, and sheep, from overdosage of RABORAL V-RG® vaccine by any route; a number of species have been dosed with 2 to 10 times the amount of vaccine in an individual ORV bait without adverse effects (USDA 1991, Rupprecht et al. 1992a). Therefore, even if domestic animals received multiple doses of vaccine by consuming multiple baits, no adverse effects would be expected to occur.

As discussed in Section 4.2.1.2, a recent study indicates vaccinia virus that originated from a strain used in smallpox vaccinations in Brazil may have become established in domestic cows in that country (Damaso et al. 2000). This indicates there is some potential for use of vaccinia virus in vaccinations to result in a new emerging infectious disease in domestic animals; however, there is currently no evidence that this type of phenomenon has occurred in the U.S. (C. Rupprecht, CDC, pers. comm. 2001). Also, the vaccinia virus strain used for smallpox vaccination in Brazil was different than the strain that is currently used in the V-RG vaccine, and the vaccinia virus portion of V-RG is more attenuated (i.e., *weaker*) than strains used in smallpox vaccines (USDA 1991). Thus, it is less likely that V-RG would result in the establishment and persistence of vaccinia virus in wild animal populations.

Instances have been reported where a pet dog has consumed several baits and then vomited the plastic sachets (R. Hale, Ohio Dept. of Health, pers. comm. 2001). Reports of these types of instances have been few, and the dogs have reportedly not experienced any substantive or long term adverse effects. USDA (2005b) documented that of the 55.3 million baits distributed during the APHIS-WS program between 1995 and 2004 only 553 instances have been reported where a pet or other domestic animal had contact with a bait. This equates to 1 domestic exposure per 100, 038 baits disbursed or 0.001 percent contact cases. No cases of adverse reaction in pets or other domestic animals have ever been reported during the APHIS-WS program. In addition, USDA (2005b) documented that 107 incidents were reported where pets came into contact with a bait in 2004; however, no reports of pets or other domestic animals experiencing any type of adverse reaction were submitted. Domestic animals that bite into and ingest a bait are most likely to be immunized against rabies or receive a boost from a previous vaccination. USDA (2005b) also documented the number of baits distributed in those states conducting ORV programs and the number of people who reported contact or potential contact with a bait by their pet or other domestic animal (i.e., carrying bait in mouth, chewing bait, vomiting sachet). The number of documented exposures equates to 0.001 percent of the 11.19 million baits distributed in 2004 or one domestic animal exposure per 104,560 baits distributed. The domestic animals reported to have been exposed to a bait involved 66 dogs, 36 unknown/unidentified pets, 3 livestock, and 2 cats (USDA 2005b), APHIS-WS concluded that adverse cumulative impacts to pets and other domestic animals continue to be negligible.

The RABORAL V-RG® vaccine distributed in baits would have no adverse effects on pets or other domestic animals. Implementation of an ORV program would likely have a moderate beneficial impact, greater than the no action alternative, by possibly immunizing these animals against rabies and reducing the likelihood of becoming exposed to an animal infected with the rabies virus.

4.2.5 Potential for the Recombined V-RG Virus to "Revert to Virulence" and Result in a Virus that could Cause Disease in Humans or Animals.

The concern here is whether the V-RG recombinant virus is genetically stable so that it would not become virulent (i.e., capable of causing disease) after it replicates (or reproduces) in animals that eat ORV baits containing the RABORAL V-RG® vaccine and, perhaps, be transmitted on to other animals. This issue was addressed in previous EAs and in formal risk assessments by USDA (USDA 1991, *undated a*, *undated b*). The Wistar Institute conducted experiments with mice in which the V-RG was "subpassaged[4]" four times into groups of mice (USDA 1991). The V-RG virus could not be found after passage through the second or third groups of mice. The experiments demonstrated that the ability of the V-RG virus to cause disease does not increase by repeated animal passage, thus "reversion to virulence" is unlikely. Further alleviating the concern about this issue is the evidence that V-RG virus does not transmit readily to other animals from animals that have consumed ORV baits (Rupprecht and Kieny 1988). Therefore, the potential for the recombined V-RG virus to "revert to virulence" would be negligible (similar to the no action alternative). The RABORAL V-RG® vaccine distributed in baits would have no adverse effects on humans or animals.

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4 This means the V-RG was inoculated into one group of mice from which material containing the virus was obtained later and injected into a second group of mice, and then material obtained from the second group was injected into a third group, etc., until four such passages had been conducted.

4.2.6 Potential for the RABORAL V-RG® Vaccine to Recombine with Other Viruses in the Wild to Form New Viruses that could Cause Disease in Humans or Animals.

The concern here is whether the RABORAL V-RG® vaccine in the ORV baits might encounter other viruses in animals, exchange genetic material with them during replication, and result in new viruses that could cause serious diseases in humans or animals. This potential recombination has been recognized as being more probable with wild pox viruses that are genetically similar to the vaccinia virus used as the vector in the RABORAL V-RG® vaccine.

Wild pox viruses present in the U.S. include skunk, rodent, and raccoon pox viruses (C. Rupprecht, CDC, pers. comm. 2001). One type of wild pox virus that would logically be considered for the possibility of recombination with vaccinia virus is raccoon pox (RP) which could occur in raccoons targeted by ORV programs in the eastern U.S. For this type of unanticipated spontaneous recombination to occur, the V-RG and RP would have to simultaneously infect the same cells in the same animal at the same time. RP has not been found to be prevalent in the environment, with only two concurrent isolations (or detections) of it having occurred in the U.S. (Herman 1964, cited in USDA 1991). Laboratory experiments on mice infected with RP and inoculated with V-RG showed no adverse effects on the mice (USDA 1991).

The Wistar Institute identified three circumstances that would have to occur simultaneously for there to be a chance of a hazardous recombination between V-RG and RP virus: (1) they would have to occur at the same time in the same animal; (2) "genome contact" (i.e., contact between the actual genetic material in the two viruses as they replicate in an infected cell); *and* (3) the regeneration of the gene that was previously removed from the vaccinia virus (known as the thymidine kinase "TK" gene) (USDA 1991). Wistar determined the probability of all three circumstances occurring at the same time was 1 chance in 100 million or less (USDA 1991). Also, if this did somehow occur resulting in a recombined virus with the functional "TK" gene reestablished, the properties and virulence of the new virus would probably be similar to the original recipient virus which is vaccinia (USDA *undated b*). Vaccinia only causes mild short-term symptoms in most cases (i.e., similar to the localized rash and pustules that occurred on the arms of many persons who received smallpox vaccinations) (USDA 1991, Elvinger 2001). Thus, recombination with wild viruses is unlikely, but, if it did occur, it is also unlikely to result in significant adverse effects on animals or people.

Combination of two types of pox viruses in rabbits or hares (leporipoxviruses) has been known to occur (Omlin 1997), but the combination of a leporipoxvirus with another unrelated pox virus has not been known to occur (USDA 1991). Rare examples of recombination between different poxviruses in animal hosts have been documented, although the probability of two viruses infecting the same cell at the same time (which is required for recombination to occur) under natural conditions remains very low (Omlin 1997). Recombination of V-RG with viruses other than orthopoxviruses is not likely (Omlin 1997). In formal risk analyses, USDA concluded that the probability of recombination with other orthopoxviruses would be limited due to the low prevalence of orthopoxviruses in wildlife species in the U.S. (USDA *undated a,undated b*).

Hahn (1992) concluded that vaccines developed by the newer genetic engineering (i.e., recombinant) techniques such as the ones used to make V-RG vaccine are no more hazardous than vaccines created by more conventional methods (e.g., "attenuation" and "fractionation"). He further indicated that, with recombinant technology, the potential for ending up with a dangerous virulent strain is probably less than with the older "hit-or-miss" methods, because the specific genetic material responsible for making a virus virulent can be removed or altered which makes the virus safer.

This analysis, which incorporates previous analyses by reference, supports a conclusion that adverse environmental effects from spontaneous recombination of V-RG with other wild viruses are exceedingly unlikely (similar to the no action alternative). This is further supported by the fact there have been no observed adverse effects in wildlife and humans both in Europe and North America following a number of years of experimental and field use of the V-RG vaccine.

4.2.7 Potential for Aerially Dropped Baits to Strike and Injure People or Domestic Animals.

ORV baits would be distributed from aircraft at an average density of 75 baits per square km (194 per sq mi) in eastern states where raccoon rabies is targeted. Those densities are sparse enough to predict that the chance of a person being struck and harmed by a falling bait is extremely remote. For example, if 100 persons were standing outdoors in a square mile of area in which ORV baits were being dropped, and each person occupies about two square ft of space at the time that baits were dropped, the chance of being struck would be 1 in 139,000 (200 sq ft total space occupied by persons divided by 27.8 million sq ft per sq mi). The negligible risk of being struck is further supported by the fact that out of more than 55.3 million baits distributed in the U.S. by APHIS-WS between 1995 and 2004, only 10 incidents have been reported in which a person claimed to have been struck by a falling bait (0.00001% chance of being struck by a bait or 1 strike per 5.53 million baits dropped) (USDA 2005b). None of the reports since APHIS-WS' ORV program inception have resulted in any injury or harm to the individuals involved.

Of the 11.19 million baits that were distributed by APHIS-WS in 2004, 1 incident was reported in which a person claimed to have been struck by a falling bait (1 strike per 11.18 million baits dropped in 2004) in Pennsylvania. No reports of injury were received during the 2004 APHIS-WS ORV program. In 2004, no cases were documented involving falling baits striking or injuring domestic animals. In 2004, 5 reports were received regarding baits striking property. The reports involved baits striking a house and a pool in West Virginia, a vehicle in Pennsylvania, a house in Ohio, and a vehicle in Virginia. The potential of falling baits striking or injuring people or domestic animals continues to be insignificant. Impacts of the program on this issue are expected to remain negligible (USDA 2005b). The potential for baits to strike people or animals is further mitigated by the fact that bait disbursal crews avoid dropping baits into cities, towns, and other areas with human dwellings, or if humans are observed below. Hand placement or dropping of baits from slower moving helicopters to allow for more precise control over the areas on which the baits are dropped would primarily be used in urban parks or suburban situations, which would further reduce the risk of being struck.

4.2.8 Cost of Raccoon Rabies ORV Programs in Comparison to Perceived Benefits.

Meltzer (1996) described a model for estimating the costs and benefits of using oral vaccines to stop or prevent raccoon rabies and identified factors important for consideration. Preventing raccoon rabies from moving into an area is generally much less expensive than the cost of elimination. The cost of eliminating raccoon rabies from New York using ORV was estimated at $72.9 million over a 10-year period. Statewide cost of raccoon rabies was estimated at $0.23 per capita pre-epizootic to $0.89 per capita once the area became infected. Comparing 1990 to 1994, New York found the rabies epizootic increased that state's annual costs over $10 million per year (Huntley et al. *unpublished* 1996).

Benefit:cost ratios of using V-RG vaccine in oral baits to control raccoon rabies in two counties in New Jersey were estimated by Uhaa et al. (1992). In that study, the estimated value of benefits was 2.21 times the cost for the most expensive vaccination program. The least expensive program resulted in benefits that exceeded costs by a factor of 6.8. The authors concluded that the program would be cost effective (Uhaa et al. 1992).

Kemere et al. (2001) conducted a detailed analysis of the expected costs compared to the expected value of benefits for establishing a barrier to prevent further westward spread of raccoon rabies that would extend from Lake Erie to the Gulf of Mexico. The barrier would combine natural barriers provided by geographical features such as the Appalachian Mountains with ORV zones. All program costs and benefits (in terms of avoided costs) were discounted to present values to provide valid comparisons. The types of costs avoided by preventing the westward spread of raccoon rabies included post-exposure vaccination treatments for humans, need for increased livestock vaccinations, and costs of increased surveillance and monitoring of rabies in wildlife and domestic animals (including laboratory diagnostic costs, costs of preparing samples for testing, and animal bite investigations). The analysis did not factor in an economic benefit for lives saved. It also did not factor in the potential benefit of decreased costs associated with nuisance and damage by raccoons or of raccoon impacts on ground nesting birds that might occur if the epizootics were not treated and raccoon populations declined as a result. It is probable that such a potential benefit would be short term (1-3 years) until local raccoon populations recovered, or were affected by other disease cycles. However, these types of outcomes are largely unpredictable.

Costs of establishing and maintaining the raccoon rabies barrier are estimated to total between $58 million and $148 million, while the estimates of net benefits ranged between $48 million and $496 million. The analysis indicated that a large scale ORV program should be economically feasible and that net economic benefits would most likely be substantial (Kemere et al. 2001).

New information continues to be published regarding the costs and benefits of managing rabies. A recent article by Sterner and Sun (2004) discussed new cost-benefit data from a comprehensive model of the costs attributed to rabies. They analyzed minimum-maximum estimates of the individual event costs (i.e., per unit cost) for 11 factors in attempt to reduce the uncertainty of economic costs linked with rabies and to identify key sources of potential savings as a result of rabies management activities. The 11 factors included: 1) pet vaccination, 2) livestock vaccination, 3) pet replacement, 4) livestock replacement, 5) pre-exposure prophylaxis, 6) post-exposure prophylaxis, 7) adverse reactions, 8) public health, 9) animal control, 10) quarantine, and 11) human death. Sterner and Sun (2004) stated that although pet vaccination and post-exposure prophylaxis have traditionally been cited as the major cost impacts of the disease, they found that the maximum and largest ranges of per unit costs were associated with livestock replacement, post-exposure prophylaxis, animal replacement, and human death. These factors help reduce the uncertainty surrounding the economic impacts of wildlife rabies and the management of this deadly virus for making informed policy decisions.

APHIS-WS and others continue to research methods that will reduce costs in managing rabies. Surveillance activities were conducted to assess aerial and/or ground ORV baiting efficacy, summer versus fall baiting schedules, and seasonal raccoon movement in a number of states. Numerous density studies were also conducted in the majority of participating states to determine raccoon densities in relation to habitat, elevation, and numbers of baits distributed. In areas where raccoon densities are low, the number of baits distributed may be reduced to increase cost effectiveness of the ORV program. The rabies management program continues to utilize natural barriers, such as mountains and rivers, in the configuration of baiting zones to reduce the number of baits used. In addition, ORV baiting strategies, such as the appropriate distance between flight lines to maximize bait uptake by target species, is assessed annually. Furthermore, studies are on-going in attempt to identify the most effective bait formulation and palatability for the target species (USDA 2005a).

These data clearly demonstrate that APHIS-WS' assistance in stopping the forward advance of various rabies strains and in reducing the incidence of rabies cases involving wild and domestic animals and rabies exposures to humans achieves the objectives of the EA. Thus, the benefit:cost ratio of the proposed action would be expected to be much greater (more desirable) than that of the no action alternative. The same logic would apply to the National Forest System lands listed in this document. In fact, by excluding USFS lands from the national ORV program, a negative effect could actually be created. If baiting programs were conducted around these large land masses, reservoirs of the virus would likely still exist, creating holes in the program and potentially making the program less effective at stopping the forward advance or eliminating the raccoon strain of the rabies virus.

4.2.9 Humaneness of Methods Used to Collect Wild Animal Specimens Critical for Timely Program Evaluation or to Reduce Local Populations of Target Species under State Contingency Plans.

Some people would view methods employed to capture and/or kill raccoons and other wild animals for monitoring and surveillance or local depopulation purposes as inhumane. Humaneness, as it relates to the killing or capturing of wildlife is an important but complex concept that can be interpreted in a variety of ways. Humaneness is a person's perception of harm or pain inflicted on an animal, and people may perceive the humaneness of an action differently.

However, humaneness as it relates to the natural world through natural mortality versus man-induced mortality must be brought into perspective. DeVos and Smith (1995) explain the characteristics of natural mortality in wildlife populations. There seems to be an increasing public perception that, left alone by humans, animal populations will experience few premature deaths and live to an old age without harm, pain or suffering. It should be recognized that wildlife populations reproduce at far greater rates than would be necessary to replace deaths if all lived to old age. To counterbalance this high reproduction, it is natural for most individuals of most species to die young, often before reaching breeding age. Natural mortality in wildlife populations includes predation, malnutrition, disease, inclement weather, and accidents. These "natural" deaths are often greater in frequency than human-caused deaths through regulated hunting, trapping, and wildlife damage management operations. From the standpoint of the animal, these natural mortality factors also may cause more suffering by wildlife, as perceived by humans, than human-induced mortality. Under given habitat conditions, most wildlife populations fluctuate around a rather specific density, sometimes called the carrying capacity. Populations that overshoot this density via reproduction become very sensitive to various sources of mortality, and death rates increase. Conversely, as populations drop, mortality rates decline (DeVos and Smith 1995). Thus, human-induced mortality - which often involves much less suffering of individual animals - invariably lessens mortality from other sources. For example, it would seem that an animal taken in a leg-hold trap or by a snare, would certainly suffer less than if it died from rabies.

Research suggests that with some methods, such as restraint in leghold traps, changes in the blood chemistry of trapped animals indicate "stress." Blood measurements indicated similar changes in foxes that had been chased by dogs for about five minutes as those restrained in traps (USDA 1997). However, such research has not yet progressed to the development of objective, quantitative measurements of pain or stress for use in evaluating humaneness. The challenge in coping with this issue is how to achieve the least amount of animal suffering with the constraints imposed by current technology. To insure the most professional handling of these issues and concerns, APHIS-WS has policies giving direction toward the achievement of the most humane program possible while still accomplishing the program's mission.

APHIS-WS has made modifications to management devices through research and development which have increased selectivity toward the species being targeted. Research is continuing with the goal of bringing new findings and products into practical use. Until such time as new findings and products are found to be practical, some animal suffering will occur during lethal collection of animal specimens if monitoring and program effectiveness objectives are to be met. Albeit, fewer animals would likely die of the raccoon rabies virus variant if the proposed action were to be implemented versus the no action alternative. Thus, the proposed action could be viewed as more humane by reducing animal suffering.

4.3 Alternative 3 -- Live-Capture-Vaccinate-Release Programs.

4.3.1 Potential for Adverse Effects on People that Become Exposed to the Vaccine or the Baits.

Under this alternative, APHIS-WS would not participate in ORV programs on National Forest System lands, but would assist with live-capture-vaccinate-release programs. For purposes of comparison, it is assumed that, with adequate APHIS-WS funding and personnel to conduct these types of programs, states would choose not to implement ORV programs on National Forest System lands.

4.3.1.1 Potential to Cause Rabies in Humans.

Live-capture-vaccinate-release programs might be as effective as ORV programs in stopping the spread of the raccoon rabies variant if conducted throughout all areas where ORV programs would have been conducted under the proposed action. The method itself would not present risk of causing rabies in members of the public. The risk of having an increase in human rabies cases because of the failure to stop epizootics of raccoon rabies would be about the same as with ORV programs under the proposed action, but would be less than the no action alternative.

4.3.1.2 Potential for Vaccinia Virus to Cause Disease in Humans.

Because it is assumed that ORV using the vaccinia virus vector in V-RG would not be used by states or by APHIS-WS on National Forest System lands, there should be no risk of vaccinia virus infections in humans caused by contact with the vaccine from ORV baits.

4.3.1.3 Potential to Cause Cancer (Oncogenicity).

No increased risk of cancer would result from this alternative.

4.3.2 Potential for Adverse Effects on Target Wildlife Species Populations.

Under this alternative, APHIS-WS would not provide funds for ORV purchase and distribution on National Forest System lands, but would assist in monitoring and surveillance programs involving the capture or lethal collection and testing of wild raccoons following live-capture-vaccinate and release activities.

4.3.2.1 Effects of the ORV V-RG Vaccine on Raccoons.

Under a live-capture-vaccinate-release alternative, it is expected that little or no ORV use by the states would occur on National Forest System lands. Thus, there would be little or no potential for the V-RG oral vaccine to affect these species.

4.3.2.2 Effects of Monitoring/Surveillance or Localized Population Reduction (Contingency Actions) on Raccoon Populations in Eastern States.

Under a live-capture-vaccinate-release alternative, it is expected that extent of lethal removal of raccoons on National Forest System lands for monitoring/surveillance activities or localized population reduction under contingency plans to address rabies outbreaks would be similar to the proposed action and slightly greater than the no action alternative. Thus, the impact on populations of raccoons would be similar to the proposed action and slightly greater than the no action alternative. Either way, however, the impact would be negligible.

4.3.3 Potential for Adverse Effects on Nontarget Wildlife Species, including Threatened or Endangered Species.

4.3.3.1 Effects of the V-RG Vaccine on Nontarget Wildlife including Threatened or Endangered Species.

Under a live-capture-vaccinate-release alternative, it is expected that little or no ORV use by the states would occur on National Forest System lands. Thus, there would be no potential for the V-RG oral vaccine to affect nontarget species. Live-capture-vaccinate-release programs would be virtually 100 percent selective for target species and would therefore have little or no potential to affect nontarget wildlife.

4.3.3.2 Effects of Capture/Removal Methods (Used in Monitoring and Surveillance or to Reduce Local Populations of Target Species under State Contingency Plans) on Nontarget Species, including Threatened or Endangered Species.

Under this alternative, APHIS-WS would assist in monitoring activities and, potentially, in localized contingency plan removals on National Forest System lands that involve the use of lethal methods such as those discussed under the proposed action. The potential for effects on nontarget species would be similar to the proposed action and slightly greater than the no action alternative. The analysis in Section 4.2.3 shows effects on nontarget and T&E species would not be significant.

4.3.4 Potential for Adverse Effects on Pet Dogs or Other Domestic Animals that Might Consume the Baits.

Live-capture-vaccinate-release programs would pose no risk of inadvertent vaccine exposure to pets or other domestic animals.

4.3.5 Potential for the Recombined V-RG Virus to "Revert to Virulence" and Result in a Virus that could Cause Disease in Humans or Animals.

Under this alternative, it is assumed that the states would not use ORV baits with the V-RG vaccine on National Forest System lands. Thus, there would be no potential for the V-RG virus to revert to a more virulent strain.

4.3.6 Potential for the V-RG Virus to Recombine with Other Viruses in the Wild to Form New Viruses that could Cause Disease in Humans or Animals.

Under this alternative, it is assumed that the states would not use ORV baits with the V-RG vaccine on National Forest System lands. Thus, there would be no potential for the V-RG virus to recombine with other viruses in the wild.

4.3.7 Potential for Aerially Dropped Baits to Strike and Injure People or Domestic Animals.

Under this alternative it is assumed there would be few or no ORV baits dropped from aircraft on National Forest System lands. Thus, there would be no potential for such baits to strike people or animals.

4.3.8 Cost of Raccoon ORV Programs in Comparison to Perceived Benefits.

A live-capture-vaccinate-release program to control rabies in skunks and raccoons was implemented in Toronto in 1992 and cost an estimated $450 to $1,150/sq km ($1,165 to $2,979/sq mi) in Canadian dollars (Rosatte et al. 1992). A more recent cost estimate of $500 Canadian/sq km for a trap-vaccinate-release program in Ontario was presented by Rosatte et al. (2001). This analysis assumes the latest cost estimate in Rosatte et al. (2001) is the most applicable for comparing this alternative with ORV programs. At the current exchange rate of 0.82878 U.S. dollars per Canadian dollar (OANDA 2005), the cost would be about $414/sq km in U.S. dollars. In contrast, Kemere et al. (2001) estimated the cost of establishing an ORV barrier of 102,650 sq km (39,623 sq mi) from Lake Erie to the Gulf coast as totaling about $121/sq km ($313/sq mi) (costs included $1.30/bait, 75 baits/sq km, $8.62/sq km for aerial distribution cost, and $15/sq km for program evaluation). This is comparable to the reported cost of ORV in Ontario of $200 Canadian/sq km ($130 U.S./sq km) (Rosatte et al. 2001). Therefore, it appears a live-capture-vaccinate-release alternative to manage raccoon rabies could cost about 2.5 times as much as the proposed action. Although a greater known proportion of targeted raccoon populations may be vaccinated by this approach (Rosatte, et al. 2001), it is probably not necessary to achieve such greater vaccination rates because ORV programs have been successful in stopping or eliminating raccoon rabies outbreaks (see Section 1.1.4). Based on the analysis in Section 4.2.8, it appears benefits may not exceed costs under this alternative. Thus, the benefit:cost ratio of this program would be less than the proposed action and the no action alternative.

4.3.9 Humaneness of Methods Used to Collect Wild Animal Specimens Critical for Timely Program Evaluation or to Reduce Local Populations of Target Species under State Contingency Plans.

Some persons would view live-capture-vaccinate-release programs as less humane than ORV programs, because large numbers of animals would experience the stress of being caught and handled to administer the vaccine. Others would view them as relatively humane compared to other types of rabies control efforts that involve lethal means to suppress target populations over broad geographic areas. Because it is believed this alternative could be as successful in stopping or preventing the spread of rabies as the proposed action, the amount of animal suffering due to contracting and dying from rabies would probably be similar to the proposed action, but less than the no action alternative.

4.4 Alternative 4 – Provide APHIS-WS Funds to Purchase and Participate in ORV Programs on Nationals Forest System Lands without Animal Specimen Collections or Lethal Removal of Animals under Contingency Plans.

Under this alternative, the states would have to fund collection of target species on National Forest System lands for monitoring and surveillance without APHIS-WS funds or personnel assistance. This would likely mean that less monitoring would be conducted. If insufficient monitoring and surveillance occurs along the leading edge of the advancing rabies strains, rabies managers would not be able to plan the most efficient and effective use of ORV baiting strategies to control the specific strains spread by wild carnivores. One possibility is that, without adequate surveillance, managers would have to resort to distributing ORV baits across more areas than necessary. The ability to stop or prevent the forward advance of specific rabies strains would likely be reduced, perhaps to the point that cooperative efforts fail.

4.4.1 Potential for Adverse Effects on People that Become Exposed to the Vaccine or the Baits.

4.4.1.1 Potential to Cause Rabies in Humans.

This alternative would present the same risk as the proposed action and the no action alternative. Since the V-RG vaccine cannot cause rabies, there would be no potential for the ORV baits to cause rabies in humans under this or any other alternative or scenario involving the distribution of V-RG oral vaccine baits. However, there would be a greater risk of human rabies cases if the lack of federal assistance in monitoring and surveillance results in a reduction in the effectiveness of ORV programs.

4.4.1.2 Potential for Vaccinia Virus to Cause Disease in Humans.

This alternative would present the same risk as the proposed action and the no action alternative. As shown by the analysis in Section 4.2.1, the risk of V-RG vaccine in ORV baits causing any health problems in humans is exceedingly low.

4.4.1.3 Potential to Cause Cancer (Oncogenicity).

This alternative would result in no probable risk of causing cancer in humans or animals, similar to the no action and other alternatives.

4.4.2 Potential for Adverse Effects on Target Wildlife Species Populations.

4.4.2.1 Effects of the ORV V-RG Vaccine on Raccoons.

This alternative would result in the same risk as the proposed action and no action, which is that adverse effects are highly unlikely. Positive effects on these species from protecting them against rabies would be similar to the proposed action and slightly greater than the no action. However, more animals are likely to die of rabies if the lack of federal assistance in monitoring and surveillance results in a reduction in the effectiveness of ORV programs.

4.4.2.2 Effects of Monitoring/Surveillance or Localized Population Reduction (Contingency Actions) on Raccoon Populations in Eastern States.

Under this alternative, APHIS-WS would not provide assistance in collecting animal specimens on National Forest System lands for monitoring purposes. The involved states could still conduct such collections; however, it is likely that fewer animals would be collected without APHIS-WS funds and assistance for that activity. Effects on raccoon populations would be exceedingly minor as supported by the analysis in Section 4.2.2.2.

4.4.3 Potential for Adverse Effects on Nontarget Wildlife Species, including Threatened or Endangered Species.

4.4.3.1 Effects of the RABORAL V-RG® Vaccine on Nontarget Wildlife including Threatened or Endangered Species.

Effects of the V-RG vaccine on nontarget wildlife would be the same as under the proposed action and the no action alternatives. The analysis in Section 4.2.3.1 showed that adverse effects are unlikely. However, more animals are likely to die of rabies if the lack of federal assistance in monitoring and surveillance results in a reduction in the effectiveness of ORV programs.

4.4.3.2 Effects of Capture/Removal Methods (Used in Monitoring and Surveillance or to Reduce Local Populations of Target Species under State Contingency Plans) on Nontarget Species, including Threatened or Endangered Species.

Under this alternative, APHIS-WS would not continue to assist in monitoring activities or local depopulation activities on National Forest System lands that involve the use of lethal methods such as those discussed under the proposed action. Therefore, the potential for adverse effects on nontarget species would be even lower than under the proposed action and slightly lower than the no action alternative. States would still likely implement monitoring and localized population reduction actions even without APHIS-WS, but such activities would likely be on a lesser scale without APHIS-WS funds. However, the analysis in Section 4.2.3.2 indicates effects on nontarget and T&E species would not be significant under the proposed action and would likely also not be significant even without APHIS-WS assistance.

4.4.4 Potential for Adverse Effects on Pet Dogs or Other Domestic Animals that Might Consume the Baits.

Under this alternative, the potential for adverse effects on domestic animals from ORV baits would be the same as the proposed action and the no action alternative. Based on the analysis in Section 4.2.4, there is almost no potential for significant adverse effects on domestic animals because of ORV bait consumption under any scenario involving the distribution of ORV baits containing the V-RG vaccine. Stopping or preventing the spread of rabies would result in beneficial effects on domestic animals by reducing their likelihood of contracting rabies. However, more domestic animals are likely to die of rabies if the lack of federal assistance in monitoring and surveillance on National Forest System lands results in a reduction in the effectiveness of ORV programs.

4.4.5 Potential for the Recombined V-RG Virus to "Revert to Virulence" and Result in a Virus that could Cause Disease in Humans or Animals.

This potential would be the same as under the proposed action and the no action. The risk of adverse effects from the V-RG virus possibly reverting to a more virulent strain would be highly remote.

4.4.6 Potential for the V-RG Virus to Recombine with Other Viruses in the Wild to Form New Viruses that could Cause Disease in Humans or Animals.

This potential would be the same as under the proposed action and no action. The risk of adverse effects from the V-RG virus possibly recombining with other viruses in the wild and resulting in significant adverse effects on human or animal health would be highly remote.

4.4.7 Potential for Aerially Dropped Baits to Strike and Injure People or Domestic Animals.

This potential would be the same as under the proposed action and slightly greater than the no action. The risk of striking and injuring people or domestic animals with baits is highly remote.

4.4.8 Cost of Raccoon ORV Programs in Comparison to Perceived Benefits.

Costs of the federal portion of state-run ORV programs would be less since no APHIS-WS funds would be spent on animal collections to be used in monitoring. Benefits would probably be similar to the proposed action, but benefits may be greater than the no action alternative. Total costs, including the expenditure of federal and state funds, might be similar if states increased activities for monitoring because of the lack of APHIS-WS funds for this type of activity. Benefits would still probably exceed costs unless reduced monitoring/surveillance results in a reduction in the effectiveness of ORV programs.

4.4.9 Humaneness of Methods Used to Collect Wild Animal Specimens Critical for Timely Program Evaluation or to Reduce Local Populations of Target Species under State Contingency Plans.

Under this alternative, no APHIS-WS funds would be used to collect animal specimens or to conduct localized population reduction of target species using live-capture or lethal methods. States could still conduct these activities, but such efforts would probably be at a lesser scale without APHIS-WS assistance. This alternative would be viewed by some persons as more humane than the proposed action and the no action alternatives. Animal suffering due to rabies would probably be similar to the proposed action, but less than the no action (i.e., greatly reduced). However, more animals are likely to suffer and die of rabies if reduced monitoring/surveillance results in a reduction in the effectiveness of ORV programs (see Section 4.2.9 for more detailed discussion).

4.5 CUMULATIVE IMPACTS

No significant cumulative environmental impacts are expected from any alternative, with the possible exception of Alternative 1 - No Action, which might lead to increased human exposures and domestic and wild animal rabies cases across much of the U.S. Although some persons will likely remain opposed to the use of recombinant vaccines or the use of the vaccinia pox virus as a component of ORV, and some will remain opposed to the lethal removal of raccoons for monitoring purposes or for implementation of contingency rabies management plans, the analysis in this EA indicates that ORV use and such lethal removals will not result in significant risk of cumulative adverse impacts on the quality of the human environment.

The analysis in this supplemental EA did not reveal any direct or indirect adverse effects on the environment and APHIS-WS is not aware of any other activities (i.e., bait distribution by air) being conducted on National Forest System lands that would create cumulative impacts. Even if the same lands are retreated in subsequent years, cumulative effects are not anticipated to occur as the ORV baits have been found safe for target and other animal species (animals can even consume numerous baits with no adverse effects), have a negligible risk of causing adverse affects to humans, are readily consumed by target animal species, and do not accumulate in the environment. In addition, a limited number of baits would be distributed one time per year, thereby limiting the potential for persons to be exposed to ORV baits or bait distributing equipment. Therefore, the analysis in this supplemental EA indicates no significant impacts on the quality of the human environment are expected from APHIS-WS continued or expanded involvement in these programs.

4.6 SUMMARY OF IMPACTS OF ALTERNATIVES FOR EACH ISSUE

Table 4-1 presents a comparison of the alternatives and environmental consequences (impacts) on each of the issues identified for detailed analysis:

Table 4-1. Issues/Impacts/Alternatives/Comparison

Issues/Impacts	**Alt. 1: No Action (no rabies control on National Forest System lands provided)**	**Alt. 2: Proposed Action (ORV and monitoring/ surveillance, potential localized target species population reduction on National Forest System lands)**	**Alt. 3: Live Capture/Vaccinate and Release on National Forest System lands**	**Alt. 4: ORV without Lethal Animal Collections or Removals on National Forest System lands**
Potential for adverse effects on people that become exposed to the vaccine or the baits.				
• Potential to cause rabies in humans.	No probable risk from ORV use by states. Higher risk of human rabies cases if states are unable to stop the spread of rabies without federal assistance.	No probable risk.	No probable risk.	No probable risk from ORV use; higher risk of human rabies cases if reduced monitoring and surveillance reduces effectiveness of ORV programs.
• Potential for vaccinia virus to cause disease in humans	States would likely still conduct ORV programs, but probably on a lesser scale without federal assistance.	Possible but risk is low; risk of significant adverse effects on individuals that experience vaccinia infections also is low. Slightly higher risk than Alt. 1	No risk.	Possible but risk is low; risk of significant adverse effects on individuals that experience vaccinia infections also is low. Slightly higher risk than Alt. 1.
• Potential to cause cancer (oncogenicity).	No probable risk.	No probable risk.	No probable risk.	No probable risk.
Potential for adverse effects on target wildlife species populations.				
• Effects of the ORV V-RG vaccine on raccoons.	No probable risk; states would likely still conduct ORV programs, but probably on a lesser scale without federal assistance.	No probable risk of adverse impacts.	No risk from V-RG vaccine.	No probable risk of adverse impact (same as Alt 2).
• Effects of monitoring and surveillance and localized population reduction actions on raccoon populations in eastern states.	States would still conduct monitoring and surveillance and contingency actions, but these are likely to be on a lesser scale without federal assistance.	Slightly higher impact than Alt. 1, but impact still very low.	Slightly higher impact than Alt. 1, but impact still very low.	Slightly lower impact than Alt. 2, same as Alt. 1; states would still conduct monitoring and surveillance and contingency actions, but these are likely to be on a lesser scale without federal assistance.
Potential for adverse effects on nontarget wildlife species, including threatened or endangered species.				

Table 4-1. Issues/Impacts/Alternatives/Comparison

• Effects of the RABORAL V-RG® vaccine on nontarget wildlife including threatened or endangered species.	No probable risk of adverse effects from ORV vaccine; but greater risk of adverse effects on these species from rabies.	No effect on T&E species; No probable risk of adverse effects on other nontarget species.	No effect on T&E species; no risk of adverse effect on other species from ORV vaccine.	No effect on T&E species; No probable risk of adverse effects on other nontarget species; but greater risk of adverse effects on these species from rabies if reduced monitoring and surveillance reduces effectiveness of ORV programs.
• Effects of capture/removal methods (used in monitoring, surveillance, and localized population reduction) on nontarget species, including threatened or endangered species.	No effect on T&E species; Very low risk of adverse effects on other nontarget species.	Probably slightly greater impact than Alt. 1. No effect on T&E species; Very low risk of adverse effects on other nontarget species.	Same as Alt. 1.	Same impact as Alt. 1; states would still conduct monitoring and surveillance and contingency actions, but these are likely to be on a lesser scale without federal assistance.
Potential for adverse effects on pet dogs or other domestic animals that might consume the baits.	Low risk; states would likely still conduct ORV programs. Increased risk of rabies for unvaccinated animals without federal assistance.	Low risk; Possible benefit from improving immunity to rabies.	No risk of adverse effects from consuming ORV baits.	Low risk; increased risk of rabies for unvaccinated animals if reduced monitoring and surveillance reduces effectiveness of ORV programs.
Potential for the recombined V-RG virus to "revert to virulence" and result in a virus that could cause disease in humans or animals.	States would likely still conduct ORV programs.	Slightly greater risk than Alt. 1, but still very low.	No risk.	Low risk (slightly greater than Alt. 1).
Potential for the V-RG virus to recombine with other viruses in the wild to form new viruses that could cause disease in humans or animals.	States would likely still conduct ORV programs.	Slightly greater risk than Alt. 1, but still very low.	No risk.	Low risk (slightly greater than Alt. 1).
Potential for aerially dropped baits to strike and injure people or domestic animals.	States would likely still conduct ORV programs.	Slightly greater risk than Alt. 1, but still low.	No risk.	Low risk (slightly greater than Alt. 1).
Cost of the program in comparison to perceived benefits.	Cost of adverse effects from rabies spread would be much greater than cost savings from not having federal assistance.	Expected benefits exceed costs of program.	Expected benefits unlikely to exceed costs of program.	Expected benefits exceed costs of program; benefits may not exceed costs if reduced monitoring and surveillance reduces effectiveness of ORV programs.
Humaneness of methods used to collect wild animal specimens critical for timely program evaluation or to reduce local populations of target species under state contingency plans	States likely to still conduct ORV programs with monitoring and surveillance and contingency plan implementation, but at a smaller scale without federal assistance; more animals likely to die of rabies if lack of federal assistance reduces effectiveness of ORV programs.	Probably more impact on this issue than Alt. 1. Capture and handling of raccoons would be viewed by some persons as inhumane. However, many animals would be saved from suffering and death due to rabies.	Capture and handling of target species would be viewed by some persons as inhumane. However, target animals would be released, so this alternative would be viewed as more humane than Alt. 1 and 2.	This Alt. would be viewed as more humane than Alt. 2 and similar to Alt. 1; states likely to still conduct monitoring and surveillance and contingency plan implementation, but at a smaller scale without federal assistance; more animals likely to die of rabies if reduced monitoring and surveillance reduces effectiveness of ORV programs.

APPENDIX A
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APPENDIX C
SPECIES LISTED AS THREATENED OR ENDANGERED UNDER THE ENDANGERED SPECIES ACT

Alabama -- 115 listings

Animals – 97

Status	Listing
E	Acornshell, southern (*Epioblasma othcaloogensis*)
T(S/A)	Alligator, American (*Alligator mississippiensis*)
E	Bat, gray (*Myotis grisescens*)
E	Bat, Indiana (*Myotis sodalis*)
XN	Bean, Cumberland (pearlymussel) AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Villosa trabalis*)
XN	Blossom, tubercled (pearlymussel) AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Epioblasma torulosa torulosa*)
E	Blossom, turgid (pearlymussel) Entire Range; Except where listed as Experimental Populations (*Epioblasma turgidula*)
XN	Blossom, turgid (pearlymussel) AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Epioblasma turgidula*)
E	Blossom, yellow (pearlymussel) Entire Range; Except where listed as Experimental Populations (*Epioblasma florentina florentina*)
XN	Blossom, yellow (pearlymussel) AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Epioblasma florentina florentina*)
E	Campeloma, slender (*Campeloma decampi*)
E	Catspaw (=purple cat's paw pearlymussel) Entire Range; Except where listed as Experimental Populations (*Epioblasma obliquata obliquata*)
XN	Catspaw (=purple cat's paw pearlymussel) AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Epioblasma obliquata obliquata*)
E	Cavefish, Alabama (*Speoplatyrhinus poulsoni*)
T	Chub, spotfin Entire (*Cyprinella monacha*)
XN	Clubshell AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Pleurobema clava*)
E	Clubshell, ovate (*Pleurobema perovatum*)
E	Clubshell, southern (*Pleurobema decisum*)
E	Combshell, Cumberlandian Entire Range; Except where listed as Experimental Populations (*Epioblasma brevidens*)
XN	Combshell, Cumberlandian AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Epioblasma brevidens*)
E	Combshell, southern (*Epioblasma penita*)
E	Combshell, upland (*Epioblasma metastriata*)
E	Darter, boulder (*Etheostoma wapiti*)
T	Darter, goldline (*Percina aurolineata*)
T	Darter, slackwater (*Etheostoma boschungi*)
T	Darter, snail (*Percina tanasi*)
E	Darter, vermilion (*Etheostoma chermocki*)
E	Darter, watercress (*Etheostoma nuchale*)
T	Eagle, bald (lower 48 States) (*Haliaeetus leucocephalus*)
T	Elimia, lacy (snail) (*Elimia crenatella*)
E	Fanshell (*Cyprogenia stegaria*)
T	Heelsplitter, Alabama (=inflated) (*Potamilus inflatus*)
E	Kidneyshell, triangular (*Ptychobranchus greeni*)
E	Lampmussel, Alabama Entire Range; Except where listed as Experimental Populations (*Lampsilis virescens*)
XN	Lampmussel, Alabama AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Lampsilis virescens*)
E	Lilliput, pale (pearlymussel) (*Toxolasma cylindrellus*)
E	Lioplax, cylindrical (snail) (*Lioplax cyclostomaformis*)
XN	Mapleleaf, winged (mussel) AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Quadrula fragosa*)
T	Moccasinshell, Alabama (*Medionidus acutissimus*)

E	Monkeyface, Cumberland (pearlymussel) Entire Range; Except where listed as Experimental Populations (*Quadrula intermedia*)
XN	Monkeyface, Cumberland (pearlymussel) AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Quadrula intermedia*)
E	Mouse, Alabama beach (*Peromyscus polionotus ammobates*)
E	Mouse, Perdido Key beach (*Peromyscus polionotus trissyllepsis*)
T	Mucket, orangenacre (*Lampsilis perovalis*)
E	Mucket, pink (pearlymussel) (*Lampsilis abrupta*)
E	Mussel, oyster Entire Range; Except where listed as Experimental Populations (*Epioblasma capsaeformis*)
XN	Mussel, oyster AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Epioblasma capsaeformis*)
XN	Pearlymussel, birdwing AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Conradilla caelata*)
E	Pearlymussel, cracking Entire Range; Except where listed as Experimental Populations (*Hemistena lata*)
XN	Pearlymussel, cracking AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Hemistena lata*)
XN	Pearlymussel, dromedary AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Dromus dromas*)
E	Pebblesnail, flat (*Lepyrium showalteri*)
E	Pigtoe, dark (*Pleurobema furvum*)
E	Pigtoe, finerayed Entire Range; Except where listed as Experimental Populations (*Fusconaia cuneolus*)
XN	Pigtoe, finerayed AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Fusconaia cuneolus*)
E	Pigtoe, flat (*Pleurobema marshalli*)
E	Pigtoe, heavy (*Pleurobema taitianum*)
E	Pigtoe, rough (*Pleurobema plenum*)
E	Pigtoe, shiny Entire Range; Except where listed as Experimental Populations (*Fusconaia cor*)
XN	Pigtoe, shiny AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Fusconaia cor*)
E	Pigtoe, southern (*Pleurobema georgianum*)
E	Pimpleback, orangefoot (pearlymussel) (*Plethobasus cooperianus*)
T	Plover, piping (except Great Lakes watershed) (*Charadrius melodus*)
T	Pocketbook, finelined (*Lampsilis altilis*)
E	Pocketbook, shinyrayed (*Lampsilis subangulata*)
E	Ring pink (mussel) (*Obovaria retusa*)
E	Riversnail, Anthony's Entire Range; Except where listed as Experimental Populations (*Athearnia anthonyi*)
XN	Riversnail, Anthony's AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Athearnia anthonyi*)
T	Rocksnail, painted (*Leptoxis taeniata*)
E	Rocksnail, plicate (*Leptoxis plicata*)
T	Rocksnail, round (*Leptoxis ampla*)
T	Salamander, Red Hills (*Phaeognathus hubrichti*)
T	Sculpin, pygmy (*Cottus paulus (=pygmaeus)*)
T	Sea turtle, green (except where endangered) (*Chelonia mydas*)
E	Sea turtle, hawksbill (*Eretmochelys imbricata*)
E	Sea turtle, Kemp's ridley (*Lepidochelys kempii*)
E	Sea turtle, leatherback (*Dermochelys coriacea*)
T	Sea turtle, loggerhead (*Caretta caretta*)
T	Shiner, blue (*Cyprinella caerulea*)
E	Shiner, Cahaba (*Notropis cahabae*)
E	Shiner, palezone (*Notropis albizonatus*)
E	Shrimp, Alabama cave (*Palaemonias alabamae*)
T	Slabshell, Chipola (*Elliptio chipolaensis*)
E	Snail, armored (*Pyrgulopsis (=Marstonia) pachyta*)
E	Snail, tulotoma (*Tulotoma magnifica*)
T	Snake, eastern indigo (*Drymarchon corais couperi*)
E	Stirrupshell (*Quadrula stapes*)
E	Stork, wood (AL, FL, GA, SC) (*Mycteria americana*)
E	Sturgeon, Alabama (*Scaphirhynchus suttkusi*)
T	Sturgeon, gulf (*Acipenser oxyrinchus desotoi*)
T	Tortoise, gopher (W of of Mobile/Tombigbee Rs.) (*Gopherus polyphemus*)
E	Turtle, Alabama red-belly (*Pseudemys alabamensis*)

T	Turtle, flattened musk (species range clarified) (*Sternotherus depressus*)
E	Wartyback, white (pearlymussel) (*Plethobasus cicatricosus*)
E	Whale, finback (*Balaenoptera physalus*)
E	Whale, humpback (*Megaptera novaeangliae*)
E	Woodpecker, red-cockaded (*Picoides borealis*)

Plants -- 18

Status	Listing
T	Amphianthus, little (*Amphianthus pusillus*)
T	Potato-bean, Price's (*Apios priceana*)
T	Fern, American hart's-tongue (*Asplenium scolopendrium* var. *americanum*)
E	Leather flower, Morefield's (*Clematis morefieldii*)
E	Leather flower, Alabama (*Clematis socialis*)
E	Prairie-clover, leafy (*Dalea foliosa*)
T	Sunflower, Eggert's (*Helianthus eggertii*)
T	Bladderpod, lyrate (*Lesquerella lyrata*)
T	Button, Mohr's Barbara (*Marshallia mohrii*)
E	Harperella (*Ptilimnium nodosum*)
T	Water-plantain, Kral's (*Sagittaria secundifolia*)
E	Pitcher-plant, green (*Sarracenia oreophila*)
E	Pitcher-plant, Alabama canebrake (*Sarracenia rubra alabamensis*)
E	Chaffseed, American (*Schwalbea americana*)
E	Pinkroot, gentian (*Spigelia gentianoides*)
T	Fern, Alabama streak-sorus (*Thelypteris pilosa* var. *alabamensis*)
E	Trillium, relict (*Trillium reliquum*)
E	Grass, Tennessee yellow-eyed (*Xyris tennesseensis*)

Connecticut -- 19 listings

Animals – 17

Status	Listing
T	Eagle, bald (lower 48 States) (*Haliaeetus leucocephalus*)
T	Plover, piping (except Great Lakes watershed) (*Charadrius melodus*)
E	Puma (=cougar), eastern (*Puma (=Felis) concolor couguar*)
T	Sea turtle, green (except where endangered) (*Chelonia mydas*)
E	Sea turtle, hawksbill (*Eretmochelys imbricata*)
E	Sea turtle, Kemp's ridley (*Lepidochelys kempii*)
E	Sea turtle, leatherback (*Dermochelys coriacea*)
T	Sea turtle, loggerhead (*Caretta caretta*)
E	Sturgeon, shortnose (*Acipenser brevirostrum*)
E	Tern, roseate (northeast U.S. nesting pop.) (*Sterna dougallii dougallii*)
T	Tiger beetle, northeastern beach (*Cicindela dorsalis dorsalis*)
T	Tiger beetle, Puritan (*Cicindela puritana*)
T	Turtle, bog (=Muhlenberg) (northern) (*Clemmys muhlenbergii*)
E	Wedgemussel, dwarf (*Alasmidonta heterodon*)
E	Whale, finback (*Balaenoptera physalus*)
E	Whale, right (*Balaena glacialis (incl. australis)*)
T	Wolf, gray Eastern Distinct Population Segment (*Canis lupus*)

Plants -- 2

Status	Listing
E	Gerardia, sandplain (*Agalinis acuta*)
T	Pogonia, small whorled (*Isotria medeoloides*)

Delaware -- 20 listings

Animals – 15

Status	Listing
T	Eagle, bald (lower 48 States) (*Haliaeetus leucocephalus*)
T	Plover, piping (except Great Lakes watershed) (*Charadrius melodus*)
E	Puma (=cougar), eastern (*Puma (=Felis) concolor couguar*)
T	Sea turtle, green (except where endangered) (*Chelonia mydas*)
E	Sea turtle, hawksbill (*Eretmochelys imbricata*)
E	Sea turtle, Kemp's ridley (*Lepidochelys kempii*)
E	Sea turtle, leatherback (*Dermochelys coriacea*)
T	Sea turtle, loggerhead (*Caretta caretta*)

E	Squirrel, Delmarva Peninsula fox (except Sussex Co., DE) (_Sciurus niger cinereus_)
XN	Squirrel, Delmarva Peninsula fox [XN] (_Sciurus niger cinereus_)
E	Sturgeon, shortnose (_Acipenser brevirostrum_)
T	Turtle, bog (=Muhlenberg) (northern) (_Clemmys muhlenbergii_)
E	Whale, finback (_Balaenoptera physalus_)
E	Whale, humpback (_Megaptera novaeangliae_)
E	Whale, right (_Balaena glacialis (incl. australis)_)

Plants -- 5

Status	Listing
T	Amaranth, seabeach (_Amaranthus pumilus_)
T	Pink, swamp (_Helonias bullata_)
T	Pogonia, small whorled (_Isotria medeoloides_)
E	Dropwort, Canby's (_Oxypolis canbyi_)
T	Beaked-rush, Knieskern's (_Rhynchospora knieskernii_)

Florida -- 111 listings

Animals – 57

Status	Listing
T(S/A)	Alligator, American (_Alligator mississippiensis_)
T	Bankclimber, purple (mussel) (_Elliptoideus sloatianus_)
E	Bat, gray (_Myotis grisescens_)
E	Butterfly, Schaus swallowtail (_Heraclides aristodemus ponceanus_)
T	Caracara, Audubon's crested (FL pop.) (_Polyborus plancus audubonii_)
XN	Crane, whooping U.S.A. (CO, ID, FL, NM, UT, and the western half of Wyoming) (_Grus americana_)
E	Crocodile, American (_Crocodylus acutus_)
E	Darter, Okaloosa (_Etheostoma okaloosae_)
E	Deer, key (_Odocoileus virginianus clavium_)
T	Eagle, bald (lower 48 States) (_Haliaeetus leucocephalus_)
T	Jay, Florida scrub (_Aphelocoma coerulescens_)
E	Kite, Everglade snail (FL pop.) (_Rostrhamus sociabilis plumbeus_)
E	Manatee, West Indian (_Trichechus manatus_)
E	Moccasinshell, Gulf (_Medionidus penicillatus_)
E	Moccasinshell, Ochlockonee (_Medionidus simpsonianus_)
E	Mouse, Anastasia Island beach (_Peromyscus polionotus phasma_)
E	Mouse, Choctawhatchee beach (_Peromyscus polionotus allophrys_)
E	Mouse, Key Largo cotton (_Peromyscus gossypinus allapaticola_)
E	Mouse, Perdido Key beach (_Peromyscus polionotus trissyllepsis_)
T	Mouse, southeastern beach (_Peromyscus polionotus niveiventris_)
E	Mouse, St. Andrew beach (_Peromyscus polionotus peninsularis_)
E	Panther, Florida (_Puma (=Felis) concolor coryi_)
E	Pigtoe, oval (_Pleurobema pyriforme_)
T	Plover, piping (except Great Lakes watershed) (_Charadrius melodus_)
E	Pocketbook, shinyrayed (_Lampsilis subangulata_)
T(S/A)	Puma (=mountain lion) (FL) (_Puma (=Felis) concolor (all subsp. except coryi)_)
E	Rabbit, Lower Keys marsh (_Sylvilagus palustris hefneri_)
E	Rice rat (lower FL Keys) (_Oryzomys palustris natator_)
T	Salamander, flatwoods (_Ambystoma cingulatum_)
E	Sea turtle, green (FL, Mexico nesting pops.) (_Chelonia mydas_)
T	Sea turtle, green (except where endangered) (_Chelonia mydas_)
E	Sea turtle, hawksbill (_Eretmochelys imbricata_)
E	Sea turtle, Kemp's ridley (_Lepidochelys kempii_)
E	Sea turtle, leatherback (_Dermochelys coriacea_)
T	Sea turtle, loggerhead (_Caretta caretta_)
E	Seal, Caribbean monk (_Monachus tropicalis_)
T	Shrimp, Squirrel Chimney Cave (_Palaemonetes cummingi_)
T	Skink, bluetail mole (_Eumeces egregius lividus_)
T	Skink, sand (_Neoseps reynoldsi_)
T	Slabshell, Chipola (_Elliptio chipolaensis_)
T	Snail, Stock Island tree (_Orthalicus reses (not incl. nesodryas)_)
T	Snake, Atlantic salt marsh (_Nerodia clarkii taeniata_)
T	Snake, eastern indigo (_Drymarchon corais couperi_)
E	Sparrow, Cape Sable seaside (_Ammodramus maritimus mirabilis_)

E	Sparrow, Florida grasshopper (*Ammodramus savannarum floridanus*)
E	Stork, wood (AL, FL, GA, SC) (*Mycteria americana*)
T	Sturgeon, gulf (*Acipenser oxyrinchus desotoi*)
E	Sturgeon, shortnose (*Acipenser brevirostrum*)
T	Tern, roseate (Western Hemisphere except NE U.S.) (*Sterna dougallii dougallii*)
E	Three-ridge, fat (mussel) (*Amblema neislerii*)
E	Vole, Florida salt marsh (*Microtus pennsylvanicus dukecampbelli*)
E	Whale, finback (*Balaenoptera physalus*)
E	Whale, humpback (*Megaptera novaeangliae*)
E	Whale, right (*Balaena glacialis (incl. australis)*)
E	Wolf, red (except where XN) (*Canis rufus*)
E	Woodpecker, red-cockaded (*Picoides borealis*)
E	Woodrat, Key Largo (*Neotoma floridana smalli*)

Plants -- 54

Status	Listing
E	Lead-plant, Crenulate (*Amorpha crenulata*)
E	Pawpaw, four-petal (*Asimina tetramera*)
T	Bonamia, Florida (*Bonamia grandiflora*)
E	Bellflower, Brooksville (*Campanula robinsiae*)
E	Prickly-apple, fragrant (*Cereus eriophorus* var. *fragrans*)
E	Spurge, deltoid (*Chamaesyce deltoidea* ssp. *deltoidea*)
T	Spurge, Garber's (*Chamaesyce garberi*)
E	Fringe-tree, pygmy (*Chionanthus pygmaeus*)
E	Aster, Florida golden (*Chrysopsis floridana*)
E	Cladonia, Florida perforate (*Cladonia perforata*)
T	Pigeon wings (*Clitoria fragrans*)
E	Rosemary, short-leaved (*Conradina brevifolia*)
E	Rosemary, Etonia (*Conradina etonia*)
E	Rosemary, Apalachicola (*Conradina glabra*)
E	Harebells, Avon Park (*Crotalaria avonensis*)
E	Gourd, Okeechobee (*Cucurbita okeechobeensis* ssp. *okeechobeensis*)
E	Pawpaw, beautiful (*Deeringothamnus pulchellus*)
E	Pawpaw, Rugel's (*Deeringothamnus rugelii*)
E	Mint, Garrett's (*Dicerandra christmanii*)
E	Mint, longspurred (*Dicerandra cornutissima*)
E	Mint, scrub (*Dicerandra frutescens*)
E	Mint, Lakela's (*Dicerandra immaculata*)
T	Buckwheat, scrub (*Eriogonum longifolium* var. *gnaphalifolium*)
E	Snakeroot (*Eryngium cuneifolium*)
T	Spurge, telephus (*Euphorbia telephioides*)
E	Milkpea, Small's (*Galactia smallii*)
T	Seagrass, Johnson's (*Halophila johnsonii*)
E	Beauty, Harper's (*Harperocallis flava*)
E	Hypericum, highlands scrub (*Hypericum cumulicola*)
E	Jacquemontia, beach (*Jacquemontia reclinata*)
E	Water-willow, Cooley's (*Justicia cooleyi*)
E	Blazingstar, scrub (*Liatris ohlingerae*)
E	Lupine, scrub (*Lupinus aridorum*)
T	Birds-in-a-nest, white (*Macbridea alba*)
E	Beargrass, Britton's (*Nolina brittoniana*)
T	Whitlow-wort, papery (*Paronychia chartacea*)
E	Cactus, Key tree (*Pilosocereus robinii*)
T	Butterwort, Godfrey's (*Pinguicula ionantha*)
E	Polygala, Lewton's (*Polygala lewtonii*)
E	Polygala, tiny (*Polygala smallii*)
E	Wireweed (*Polygonella basiramia*)
E	Sandlace (*Polygonella myriophylla*)
E	Plum, scrub (*Prunus geniculata*)
E	Rhododendron, Chapman (*Rhododendron chapmanii*)
T	Gooseberry, Miccosukee (*Ribes echinellum*)
E	Chaffseed, American (*Schwalbea americana*)
T	Skullcap, Florida (*Scutellaria floridana*)

E	Campion, fringed (*Silene polypetala*)
E	Pinkroot, gentian (*Spigelia gentianoides*)
E	Meadowrue, Cooley's (*Thalictrum cooleyi*)
E	Torreya, Florida (*Torreya taxifolia*)
E	Warea, wide-leaf (*Warea amplexifolia*)
E	Mustard, Carter's (*Warea carteri*)
E	Ziziphus, Florida (*Ziziphus celata*)

Georgia -- 66 listings

Animals – 43

Status	Listing
E	Acornshell, southern (*Epioblasma othcaloogensis*)
T(S/A)	Alligator, American (*Alligator mississippiensis*)
T	Bankclimber, purple (mussel) (*Elliptoideus sloatianus*)
E	Bat, gray (*Myotis grisescens*)
E	Bat, Indiana (*Myotis sodalis*)
E	Clubshell, southern (*Pleurobema decisum*)
E	Combshell, upland (*Epioblasma metastriata*)
E	Darter, amber (*Percina antesella*)
T	Darter, Cherokee (*Etheostoma scotti*)
E	Darter, Etowah (*Etheostoma etowahae*)
T	Darter, goldline (*Percina aurolineata*)
T	Darter, snail (*Percina tanasi*)
T	Eagle, bald (lower 48 States) (*Haliaeetus leucocephalus*)
E	Kidneyshell, triangular (*Ptychobranchus greeni*)
E	Logperch, Conasauga (*Percina jenkinsi*)
E	Manatee, West Indian (*Trichechus manatus*)
T	Moccasinshell, Alabama (*Medionidus acutissimus*)
E	Moccasinshell, Coosa (*Medionidus parvulus*)
E	Moccasinshell, Gulf (*Medionidus penicillatus*)
E	Moccasinshell, Ochlockonee (*Medionidus simpsonianus*)
XN	Mussel, oyster AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Epioblasma capsaeformis*)
E	Pigtoe, oval (*Pleurobema pyriforme*)
E	Pigtoe, southern (*Pleurobema georgianum*)
T	Plover, piping (except Great Lakes watershed) (*Charadrius melodus*)
T	Pocketbook, finelined (*Lampsilis altilis*)
E	Pocketbook, shinyrayed (*Lampsilis subangulata*)
XN	Riversnail, Anthony's AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Athearnia anthonyi*)
T	Salamander, flatwoods (*Ambystoma cingulatum*)
T	Sea turtle, green (except where endangered) (*Chelonia mydas*)
E	Sea turtle, hawksbill (*Eretmochelys imbricata*)
E	Sea turtle, Kemp's ridley (*Lepidochelys kempii*)
E	Sea turtle, leatherback (*Dermochelys coriacea*)
T	Sea turtle, loggerhead (*Caretta caretta*)
T	Shiner, blue (*Cyprinella caerulea*)
T	Snake, eastern indigo (*Drymarchon corais couperi*)
E	Stork, wood (AL, FL, GA, SC) (*Mycteria americana*)
E	Sturgeon, shortnose (*Acipenser brevirostrum*)
T	Tern, roseate (Western Hemisphere except NE U.S.) (*Sterna dougallii dougallii*)
T(S/A)	Turtle, bog (=Muhlenberg) (southern) (*Clemmys muhlenbergii*)
E	Whale, finback (*Balaenoptera physalus*)
E	Whale, humpback (*Megaptera novaeangliae*)
E	Whale, right (*Balaena glacialis (incl. australis)*)
E	Woodpecker, red-cockaded (*Picoides borealis*)

Plants -- 23

Status	Listing
T	Amphianthus, little (*Amphianthus pusillus*)
E	Rattleweed, hairy (*Baptisia arachnifera*)
E	Leather flower, Alabama (*Clematis socialis*)
E	Coneflower, smooth (*Echinacea laevigata*)

T Pink, swamp (*Helonias bullata*)
E Quillwort, black spored (*Isoetes melanospora*)
E Quillwort, mat-forming (*Isoetes tegetiformans*)
T Pogonia, small whorled (*Isotria medeoloides*)
E Pondberry (*Lindera melissifolia*)
T Button, Mohr's Barbara (*Marshallia mohrii*)
E Dropwort, Canby's (*Oxypolis canbyi*)
E Harperella (*Ptilimnium nodosum*)
E Sumac, Michaux's (*Rhus michauxii*)
T Water-plantain, Kral's (*Sagittaria secundifolia*)
E Pitcher-plant, green (*Sarracenia oreophila*)
E Chaffseed, American (*Schwalbea americana*)
T Skullcap, large-flowered (*Scutellaria montana*)
E Campion, fringed (*Silene polypetala*)
T Spiraea, Virginia (*Spiraea virginiana*)
E Torreya, Florida (*Torreya taxifolia*)
E Trillium, persistent (*Trillium persistens*)
E Trillium, relict (*Trillium reliquum*)
E Grass, Tennessee yellow-eyed (*Xyris tennesseensis*)

Indiana -- 29 listings
Animals – 25
Status Listing
E Bat, gray (*Myotis grisescens*)
E Bat, Indiana (*Myotis sodalis*)
E Blossom, tubercled (pearlymussel) Entire Range; Except where listed as Experimental Populations (*Epioblasma torulosa torulosa*)
XN Blossom, tubercled (pearlymussel) AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Epioblasma torulosa torulosa*)
E Butterfly, Karner blue (*Lycaeides melissa samuelis*)
E Butterfly, Mitchell's satyr (*Neonympha mitchellii mitchellii*)
XN Catspaw (=purple cat's paw pearlymussel) AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Epioblasma obliquata obliquata*)
E Catspaw, white (pearlymussel) (*Epioblasma obliquata perobliqua*)
E Clubshell Entire Range; Except where listed as Experimental Populations (*Pleurobema clava*)
T Eagle, bald (lower 48 States) (*Haliaeetus leucocephalus*)
E Fanshell (*Cyprogenia stegaria*)
E Mucket, pink (pearlymussel) (*Lampsilis abrupta*)
E Pearlymussel, cracking Entire Range; Except where listed as Experimental Populations (*Hemistena lata*)
E Pigtoe, rough (*Pleurobema plenum*)
E Pimpleback, orangefoot (pearlymussel) (*Plethobasus cooperianus*)
E Plover, piping (Great Lakes watershed) (*Charadrius melodus*)
T Plover, piping (except Great Lakes watershed) (*Charadrius melodus*)
E Pocketbook, fat (*Potamilus capax*)
E Puma (=cougar), eastern (*Puma (=Felis) concolor couguar*)
E Riffleshell, northern (*Epioblasma torulosa rangiana*)
E Ring pink (mussel) (*Obovaria retusa*)
T Snake, copperbelly water (MI, OH, IN N of 400 N. Lat.) (*Nerodia erythrogaster neglecta*)
E Tern, least (interior pop.) (*Sterna antillarum*)
E Wartyback, white (pearlymussel) (*Plethobasus cicatricosus*)
T Wolf, gray Eastern Distinct Population Segment (*Canis lupus*)
Plants -- 4
Status Listing
T Milkweed, Mead's (*Asclepias meadii*)
T Thistle, Pitcher's (*Cirsium pitcheri*)
E Goldenrod, Short's (*Solidago shortii*)
E Clover, running buffalo (*Trifolium stoloniferum*)

Kentucky -- 47 listings
Animals -- 38
Status Listing
E Bat, gray (*Myotis grisescens*)

E Bat, Indiana (_Myotis sodalis_)
E Bat, Virginia big-eared (_Corynorhinus (=Plecotus) townsendii virginianus_)
E Bean, Cumberland (pearlymussel) Entire Range; Except where listed as Experimental Populations (_Villosa trabalis_)
XN Bean, Cumberland (pearlymussel) AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (_Villosa trabalis_)
E Blossom, tubercled (pearlymussel) Entire Range; Except where listed as Experimental Populations (_Epioblasma torulosa torulosa_)
XN Blossom, tubercled (pearlymussel) AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (_Epioblasma torulosa torulosa_)
E Catspaw (=purple cat's paw pearlymussel) Entire Range; Except where listed as Experimental Populations (_Epioblasma obliquata obliquata_)
XN Catspaw (=purple cat's paw pearlymussel) AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (_Epioblasma obliquata obliquata_)
E Clubshell Entire Range; Except where listed as Experimental Populations (_Pleurobema clava_)
E Combshell, Cumberlandian Entire Range; Except where listed as Experimental Populations (_Epioblasma brevidens_)
XN Combshell, Cumberlandian AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (_Epioblasma brevidens_)
T Dace, blackside (_Phoxinus cumberlandensis_)
E Darter, duskytail Entire (_Etheostoma percnurum_)
E Darter, relict (_Etheostoma chienense_)
T Eagle, bald (lower 48 States) (_Haliaeetus leucocephalus_)
E Elktoe, Cumberland (_Alasmidonta atropurpurea_)
E Fanshell (_Cyprogenia stegaria_)
E Mapleleaf, winged (mussel) Entire; except where listed as experimental populations (_Quadrula fragosa_)
E Mucket, pink (pearlymussel) (_Lampsilis abrupta_)
E Mussel, oyster Entire Range; Except where listed as Experimental Populations (_Epioblasma capsaeformis_)
XN Mussel, oyster AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (_Epioblasma capsaeformis_)
E Pearlymussel, cracking Entire Range; Except where listed as Experimental Populations (_Hemistena lata_)
E Pearlymussel, dromedary Entire Range; Except where listed as Experimental Populations (_Dromus dromas_)
E Pearlymussel, littlewing (_Pegias fabula_)
E Pigtoe, rough (_Pleurobema plenum_)
E Pimpleback, orangefoot (pearlymussel) (_Plethobasus cooperianus_)
T Plover, piping (except Great Lakes watershed) (_Charadrius melodus_)
E Pocketbook, fat (_Potamilus capax_)
E Puma (=cougar), eastern (_Puma (=Felis) concolor couguar_)
E Riffleshell, northern (_Epioblasma torulosa rangiana_)
E Riffleshell, tan (_Epioblasma florentina walkeri (=E. walkeri)_)
E Ring pink (mussel) (_Obovaria retusa_)
E Shiner, palezone (_Notropis albizonatus_)
E Shrimp, Kentucky cave (_Palaemonias ganteri_)
E Sturgeon, pallid (_Scaphirhynchus albus_)
E Tern, least (interior pop.) (_Sterna antillarum_)
E Wartyback, white (pearlymussel) (_Plethobasus cicatricosus_)

Plants -- 9

Status Listing
T Potato-bean, Price's (_Apios priceana_)
E Rock-cress, Braun's (_Arabis perstellata_)
E Sandwort, Cumberland (_Arenaria cumberlandensis_)
T Rosemary, Cumberland (_Conradina verticillata_)
T Sunflower, Eggert's (_Helianthus eggertii_)
T Goldenrod, white-haired (_Solidago albopilosa_)
E Goldenrod, Short's (_Solidago shortii_)
T Spiraea, Virginia (_Spiraea virginiana_)
E Clover, running buffalo (_Trifolium stoloniferum_)

Louisiana -- 26 listings

Animals – 23

Status Listing
T(S/A) Alligator, American (_Alligator mississippiensis_)

T(S/A) Bear, American black (County range of LA b.bear) (*Ursus americanus*)
T Bear, Louisiana black (*Ursus americanus luteolus*)
T Eagle, bald (lower 48 States) (*Haliaeetus leucocephalus*)
T Heelsplitter, Alabama (=inflated) (*Potamilus inflatus*)
E Mucket, pink (pearlymussel) (*Lampsilis abrupta*)
T Pearlshell, Louisiana (*Margaritifera hembeli*)
E Pelican, brown (except U.S. Atlantic coast, FL, AL) (*Pelecanus occidentalis*)
T Plover, piping (except Great Lakes watershed) (*Charadrius melodus*)
T Sea turtle, green (except where endangered) (*Chelonia mydas*)
E Sea turtle, hawksbill (*Eretmochelys imbricata*)
E Sea turtle, Kemp's ridley (*Lepidochelys kempii*)
E Sea turtle, leatherback (*Dermochelys coriacea*)
T Sea turtle, loggerhead (*Caretta caretta*)
T Sturgeon, gulf (*Acipenser oxyrinchus desotoi*)
E Sturgeon, pallid (*Scaphirhynchus albus*)
E Tern, least (interior pop.) (*Sterna antillarum*)
T Tortoise, gopher (W of of Mobile/Tombigbee Rs.) (*Gopherus polyphemus*)
T Turtle, ringed map (*Graptemys oculifera*)
E Vireo, black-capped (*Vireo atricapilla*)
E Whale, finback (*Balaenoptera physalus*)
E Whale, humpback (*Megaptera novaeangliae*)
E Woodpecker, red-cockaded (*Picoides borealis*)
Plants -- 3
Status Listing
T *Geocarpon minimum* (No common name)
E Quillwort, Louisiana (*Isoetes louisianensis*)
E Chaffseed, American (*Schwalbea americana*)

Maine -- 15 listings
Animals – 12
Status Listing
T Eagle, bald (lower 48 States) (*Haliaeetus leucocephalus*)
T Lynx, Canada (*Lynx canadensis*)
T Plover, piping (except Great Lakes watershed) (*Charadrius melodus*)
E Puma (=cougar), eastern (*Puma (=Felis) concolor couguar*)
E Salmon, Atlantic Gulf of Maine Atlantic Salmon DPS (*Salmo salar*)
E Sea turtle, leatherback (*Dermochelys coriacea*)
E Sturgeon, shortnose (*Acipenser brevirostrum*)
E Tern, roseate (northeast U.S. nesting pop.) (*Sterna dougallii dougallii*)
E Whale, finback (*Balaenoptera physalus*)
E Whale, humpback (*Megaptera novaeangliae*)
E Whale, right (*Balaena glacialis (incl. australis)*)
T Wolf, gray Eastern Distinct Population Segment (*Canis lupus*)
Plants -- 3
Status Listing
T Pogonia, small whorled (*Isotria medeoloides*)
E Lousewort, Furbish (*Pedicularis furbishiae*)
T Orchid, eastern prairie fringed (*Platanthera leucophaea*)

Maryland -- 26 listings
Animals – 19
Status Listing
E Bat, Indiana (*Myotis sodalis*)
E Darter, Maryland (*Etheostoma sellare*)
T Eagle, bald (lower 48 States) (*Haliaeetus leucocephalus*)
T Plover, piping (except Great Lakes watershed) (*Charadrius melodus*)
E Puma (=cougar), eastern (*Puma (=Felis) concolor couguar*)
T Sea turtle, green (except where endangered) (*Chelonia mydas*)
E Sea turtle, hawksbill (*Eretmochelys imbricata*)
E Sea turtle, Kemp's ridley (*Lepidochelys kempii*)
E Sea turtle, leatherback (*Dermochelys coriacea*)
T Sea turtle, loggerhead (*Caretta caretta*)

E Squirrel, Delmarva Peninsula fox (except Sussex Co., DE) (*Sciurus niger cinereus*)
E Sturgeon, shortnose (*Acipenser brevirostrum*)
T Tiger beetle, northeastern beach (*Cicindela dorsalis dorsalis*)
T Tiger beetle, Puritan (*Cicindela puritana*)
T Turtle, bog (=Muhlenberg) (northern) (*Clemmys muhlenbergii*)
E Wedgemussel, dwarf (*Alasmidonta heterodon*)
E Whale, finback (*Balaenoptera physalus*)
E Whale, humpback (*Megaptera novaeangliae*)
E Whale, right (*Balaena glacialis (incl. australis)*)

Plants – 7

Status	Listing
T	Joint-vetch, sensitive (*Aeschynomene virginica*)
E	Gerardia, sandplain (*Agalinis acuta*)
T	Amaranth, seabeach (*Amaranthus pumilus*)
T	Pink, swamp (*Helonias bullata*)
E	Dropwort, Canby's (*Oxypolis canbyi*)
E	Harperella (*Ptilimnium nodosum*)
E	Bulrush, Northeastern (*Scirpus ancistrochaetus*)

Massachusetts -- 24 listings

Animals – 21

Status	Listing
E	Beetle, American burying (*Nicrophorus americanus*)
E	Cooter (=turtle), northern redbelly (=Plymouth) (*Pseudemys rubriventris bangsi*)
T	Eagle, bald (lower 48 States) (*Haliaeetus leucocephalus*)
T	Plover, piping (except Great Lakes watershed) (*Charadrius melodus*)
E	Puma (=cougar), eastern (*Puma (=Felis) concolor couguar*)
E	Sea turtle, hawksbill (*Eretmochelys imbricata*)
E	Sea turtle, Kemp's ridley (*Lepidochelys kempii*)
E	Sea turtle, leatherback (*Dermochelys coriacea*)
T	Sea turtle, loggerhead (*Caretta caretta*)
E	Sturgeon, shortnose (*Acipenser brevirostrum*)
E	Tern, roseate (northeast U.S. nesting pop.) (*Sterna dougallii dougallii*)
T	Tiger beetle, northeastern beach (*Cicindela dorsalis dorsalis*)
T	Tiger beetle, Puritan (*Cicindela puritana*)
T	Turtle, bog (=Muhlenberg) (northern) (*Clemmys muhlenbergii*)
E	Wedgemussel, dwarf (*Alasmidonta heterodon*)
E	Whale, blue (*Balaenoptera musculus*)
E	Whale, finback (*Balaenoptera physalus*)
E	Whale, humpback (*Megaptera novaeangliae*)
E	Whale, right (*Balaena glacialis (incl. australis)*)
E	Whale, Sei (*Balaenoptera borealis*)
T	Wolf, gray Eastern Distinct Population Segment (*Canis lupus*)

Plants -- 3

Status	Listing
E	Gerardia, sandplain (*Agalinis acuta*)
T	Pogonia, small whorled (*Isotria medeoloides*)
E	Bulrush, Northeastern (*Scirpus ancistrochaetus*)

Michigan -- 21 listings

Animals – 13

Status	Listing
E	Bat, Indiana (*Myotis sodalis*)
E	Beetle, American burying (*Nicrophorus americanus*)
E	Beetle, Hungerford's crawling water (*Brychius hungerfordi*)
E	Butterfly, Karner blue (*Lycaeides melissa samuelis*)
E	Butterfly, Mitchell's satyr (*Neonympha mitchellii mitchellii*)
E	Clubshell Entire Range; Except where listed as Experimental Populations (*Pleurobema clava*)
T	Eagle, bald (lower 48 States) (*Haliaeetus leucocephalus*)
E	Plover, piping (Great Lakes watershed) (*Charadrius melodus*)
E	Puma (=cougar), eastern (*Puma (=Felis) concolor couguar*)
E	Riffleshell, northern (*Epioblasma torulosa rangiana*)

T Snake, copperbelly water (MI, OH, IN N of 400 N. Lat.) (*Nerodia erythrogaster neglecta*)
E Warbler (=wood), Kirtland's (*Dendroica kirtlandii*)
T Wolf, gray Eastern Distinct Population Segment (*Canis lupus*)

Plants -- 8

Status	Listing
T	Fern, American hart's-tongue (*Asplenium scolopendrium* var. *americanum*)
T	Thistle, Pitcher's (*Cirsium pitcheri*)
T	Daisy, lakeside (*Hymenoxys herbacea*)
T	Iris, dwarf lake (*Iris lacustris*)
T	Pogonia, small whorled (*Isotria medeoloides*)
E	Monkey-flower, Michigan (*Mimulus glabratus* var. *michiganensis*)
T	Orchid, eastern prairie fringed (*Platanthera leucophaea*)
T	Goldenrod, Houghton's (*Solidago houghtonii*)

Mississippi -- 38 listings

Animals -- 34

Status	Listing
T(S/A)	Alligator, American (*Alligator mississippiensis*)
E	Bat, Indiana (*Myotis sodalis*)
T(S/A)	Bear, American black (County range of LA b.bear) (*Ursus americanus*)
T	Bear, Louisiana black (*Ursus americanus luteolus*)
E	Clubshell, black (*Pleurobema curtum*)
E	Clubshell, ovate (*Pleurobema perovatum*)
E	Clubshell, southern (*Pleurobema decisum*)
E	Combshell, southern (*Epioblasma penita*)
E	Crane, Mississippi sandhill (*Grus canadensis pulla*)
T	Darter, bayou (*Etheostoma rubrum*)
T	Eagle, bald (lower 48 States) (*Haliaeetus leucocephalus*)
E	Frog, Mississippi gopher Wherever found west of Mobile and Tombigbee Rivers in AL, MS, and LA. (*Rana capito sevosa*)
T	Moccasinshell, Alabama (*Medionidus acutissimus*)
T	Mucket, orangenacre (*Lampsilis perovalis*)
E	Pelican, brown (except U.S. Atlantic coast, FL, AL) (*Pelecanus occidentalis*)
E	Pigtoe, flat (*Pleurobema marshalli*)
T	Plover, piping (except Great Lakes watershed) (*Charadrius melodus*)
E	Pocketbook, fat (*Potamilus capax*)
T	Sea turtle, green (except where endangered) (*Chelonia mydas*)
E	Sea turtle, hawksbill (*Eretmochelys imbricata*)
E	Sea turtle, Kemp's ridley (*Lepidochelys kempii*)
E	Sea turtle, leatherback (*Dermochelys coriacea*)
T	Sea turtle, loggerhead (*Caretta caretta*)
E	Stirrupshell (*Quadrula stapes*)
E	Sturgeon, Alabama (*Scaphirhynchus suttkusi*)
T	Sturgeon, gulf (*Acipenser oxyrinchus desotoi*)
E	Sturgeon, pallid (*Scaphirhynchus albus*)
E	Tern, least (interior pop.) (*Sterna antillarum*)
T	Tortoise, gopher (W of of Mobile/Tombigbee Rs.) (*Gopherus polyphemus*)
T	Turtle, ringed map (*Graptemys oculifera*)
T	Turtle, yellow-blotched map (*Graptemys flavimaculata*)
E	Whale, finback (*Balaenoptera physalus*)
E	Whale, humpback (*Megaptera novaeangliae*)
E	Woodpecker, red-cockaded (*Picoides borealis*)

Plants -- 4

Status	Listing
T	Potato-bean, Price's (*Apios priceana*)
E	Quillwort, Louisiana (*Isoetes louisianensis*)
E	Pondberry (*Lindera melissifolia*)
E	Chaffseed, American (*Schwalbea americana*)

New Hampshire -- 12 listings

Animals – 9

Status Listing

E	Butterfly, Karner blue (*Lycaeides melissa samuelis*)
T	Eagle, bald (lower 48 States) (*Haliaeetus leucocephalus*)
T	Plover, piping (except Great Lakes watershed) (*Charadrius melodus*)
E	Puma (=cougar), eastern (*Puma (=Felis) concolor couguar*)
E	Sea turtle, leatherback (*Dermochelys coriacea*)
T	Tiger beetle, Puritan (*Cicindela puritana*)
E	Wedgemussel, dwarf (*Alasmidonta heterodon*)
E	Whale, finback (*Balaenoptera physalus*)
T	Wolf, gray Eastern Distinct Population Segment (*Canis lupus*)

Plants -- 3

Status	Listing
E	Milk-vetch, Jesup's (*Astragalus robbinsii* var. *jesupi*)
T	Pogonia, small whorled (*Isotria medeoloides*)
E	Bulrush, Northeastern (*Scirpus ancistrochaetus*)

New Jersey -- 23 listings

Animals -- 17

Status	Listing
E	Bat, Indiana (*Myotis sodalis*)
T	Eagle, bald (lower 48 States) (*Haliaeetus leucocephalus*)
T	Plover, piping (except Great Lakes watershed) (*Charadrius melodus*)
E	Puma (=cougar), eastern (*Puma (=Felis) concolor couguar*)
E	Sea turtle, hawksbill (*Eretmochelys imbricata*)
E	Sea turtle, Kemp's ridley (*Lepidochelys kempii*)
E	Sea turtle, leatherback (*Dermochelys coriacea*)
T	Sea turtle, loggerhead (*Caretta caretta*)
E	Sturgeon, shortnose (*Acipenser brevirostrum*)
E	Tern, roseate (northeast U.S. nesting pop.) (*Sterna dougallii dougallii*)
T	Tiger beetle, northeastern beach (*Cicindela dorsalis dorsalis*)
T	Turtle, bog (=Muhlenberg) (northern) (*Clemmys muhlenbergii*)
E	Wedgemussel, dwarf (*Alasmidonta heterodon*)
E	Whale, finback (*Balaenoptera physalus*)
E	Whale, humpback (*Megaptera novaeangliae*)
E	Whale, right (*Balaena glacialis (incl. australis)*)
T	Wolf, gray Eastern Distinct Population Segment (*Canis lupus*)

Plants -- 6

Status	Listing
T	Joint-vetch, sensitive (*Aeschynomene virginica*)
T	Amaranth, seabeach (*Amaranthus pumilus*)
T	Pink, swamp (*Helonias bullata*)
T	Pogonia, small whorled (*Isotria medeoloides*)
T	Beaked-rush, Knieskern's (*Rhynchospora knieskernii*)
E	Chaffseed, American (*Schwalbea americana*)

New York -- 26 listings

Animals – 20

Status	Listing
E	Bat, Indiana (*Myotis sodalis*)
E	Butterfly, Karner blue (*Lycaeides melissa samuelis*)
T	Eagle, bald (lower 48 States) (*Haliaeetus leucocephalus*)
E	Plover, piping (Great Lakes watershed) (*Charadrius melodus*)
T	Plover, piping (except Great Lakes watershed) (*Charadrius melodus*)
E	Puma (=cougar), eastern (*Puma (=Felis) concolor couguar*)
T	Sea turtle, green (except where endangered) (*Chelonia mydas*)
E	Sea turtle, hawksbill (*Eretmochelys imbricata*)
E	Sea turtle, Kemp's ridley (*Lepidochelys kempii*)
E	Sea turtle, leatherback (*Dermochelys coriacea*)
T	Sea turtle, loggerhead (*Caretta caretta*)
T	Snail, Chittenango ovate amber (*Succinea chittenangoensis*)
E	Sturgeon, shortnose (*Acipenser brevirostrum*)
E	Tern, roseate (northeast U.S. nesting pop.) (*Sterna dougallii dougallii*)
T	Turtle, bog (=Muhlenberg) (northern) (*Clemmys muhlenbergii*)

E	Wedgemussel, dwarf (*Alasmidonta heterodon*)
E	Whale, finback (*Balaenoptera physalus*)
E	Whale, humpback (*Megaptera novaeangliae*)
E	Whale, right (*Balaena glacialis (incl. australis)*)
T	Wolf, gray Eastern Distinct Population Segment (*Canis lupus*)

Plants -- 6

Status	Listing
T	Monkshood, northern wild (*Aconitum noveboracense*)
E	Gerardia, sandplain (*Agalinis acuta*)
T	Amaranth, seabeach (*Amaranthus pumilus*)
T	Fern, American hart's-tongue (*Asplenium scolopendrium* var. *americanum*)
T	Roseroot, Leedy's (*Sedum integrifolium* ssp. *leedyi*)
T	Goldenrod, Houghton's (*Solidago houghtonii*)

North Carolina -- 63 listings

Animals -- 36

Status	Listing
T(S/A)	Alligator, American (*Alligator mississippiensis*)
E	Bat, Indiana (*Myotis sodalis*)
E	Bat, Virginia big-eared (*Corynorhinus (=Plecotus) townsendii virginianus*)
E	Butterfly, Saint Francis' satyr (*Neonympha mitchellii francisci*)
T	Chub, spotfin Entire (*Cyprinella monacha*)
T	Eagle, bald (lower 48 States) (*Haliaeetus leucocephalus*)
E	Elktoe, Appalachian (*Alasmidonta raveneliana*)
E	Heelsplitter, Carolina (*Lasmigona decorata*)
XN	Mussel, oyster AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Epioblasma capsaeformis*)
E	Pearlymussel, littlewing (*Pegias fabula*)
T	Plover, piping (except Great Lakes watershed) (*Charadrius melodus*)
E	Puma (=cougar), eastern (*Puma (=Felis) concolor couguar*)
T	Sea turtle, green (except where endangered) (*Chelonia mydas*)
E	Sea turtle, hawksbill (*Eretmochelys imbricata*)
E	Sea turtle, Kemp's ridley (*Lepidochelys kempii*)
E	Sea turtle, leatherback (*Dermochelys coriacea*)
T	Sea turtle, loggerhead (*Caretta caretta*)
E	Shiner, Cape Fear (*Notropis mekistocholas*)
T	Silverside, Waccamaw (*Menidia extensa*)
T	Snail, noonday (*Mesodon clarki nantahala*)
E	Spider, spruce-fir moss (*Microhexura montivaga*)
E	Spinymussel, James (*Pleurobema collina*)
E	Spinymussel, Tar River (*Elliptio steinstansana*)
E	Squirrel, Carolina northern flying (*Glaucomys sabrinus coloratus*)
E	Sturgeon, shortnose (*Acipenser brevirostrum*)
E	Tern, roseate (northeast U.S. nesting pop.) (*Sterna dougallii dougallii*)
T	Tern, roseate (Western Hemisphere except NE U.S.) (*Sterna dougallii dougallii*)
T(S/A)	Turtle, bog (=Muhlenberg) (southern) (*Clemmys muhlenbergii*)
E	Wedgemussel, dwarf (*Alasmidonta heterodon*)
E	Whale, finback (*Balaenoptera physalus*)
E	Whale, humpback (*Megaptera novaeangliae*)
E	Whale, right (*Balaena glacialis (incl. australis)*)
E	Whale, sperm (*Physeter catodon (=macrocephalus)*)
E	Wolf, red (except where XN) (*Canis rufus*)
XN	Wolf, red [XN] (*Canis rufus*)
E	Woodpecker, red-cockaded (*Picoides borealis*)

Plants -- 27

Status	Listing
T	Joint-vetch, sensitive (*Aeschynomene virginica*)
T	Amaranth, seabeach (*Amaranthus pumilus*)
E	Bittercress, small-anthered (*Cardamine micranthera*)
E	Sedge, golden (*Carex lutea*)
E	Coneflower, smooth (*Echinacea laevigata*)
E	Avens, spreading (*Geum radiatum*)

E	Lichen, rock gnome (_Gymnoderma lineare_)
E	Bluet, Roan Mountain (_Hedyotis purpurea_ var. _montana_)
E	Sunflower, Schweinitz's (_Helianthus schweinitzii_)
T	Pink, swamp (_Helonias bullata_)
T	Heartleaf, dwarf-flowered (_Hexastylis naniflora_)
T	Heather, mountain golden (_Hudsonia montana_)
T	Pogonia, small whorled (_Isotria medeoloides_)
T	Blazingstar, Heller's (_Liatris helleri_)
E	Pondberry (_Lindera melissifolia_)
E	Loosestrife, rough-leaved (_Lysimachia asperulaefolia_)
E	Dropwort, Canby's (_Oxypolis canbyi_)
E	Harperella (_Ptilimnium nodosum_)
E	Sumac, Michaux's (_Rhus michauxii_)
E	Arrowhead, bunched (_Sagittaria fasciculata_)
E	Pitcher-plant, green (_Sarracenia oreophila_)
E	Pitcher-plant, mountain sweet (_Sarracenia rubra_ ssp. _jonesii_)
E	Chaffseed, American (_Schwalbea americana_)
E	Irisette, white (_Sisyrinchium dichotomum_)
T	Goldenrod, Blue Ridge (_Solidago spithamaea_)
T	Spiraea, Virginia (_Spiraea virginiana_)
E	Meadowrue, Cooley's (_Thalictrum cooleyi_)

Ohio -- 26 listings
Animals – 20
Status	Listing
E	Bat, Indiana (_Myotis sodalis_)
E	Beetle, American burying (_Nicrophorus americanus_)
E	Butterfly, Karner blue (_Lycaeides melissa samuelis_)
E	Butterfly, Mitchell's satyr (_Neonympha mitchellii mitchellii_)
E	Catspaw (=purple cat's paw pearlymussel) Entire Range; Except where listed as Experimental Populations (_Epioblasma obliquata obliquata_)
XN	Catspaw (=purple cat's paw pearlymussel) AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (_Epioblasma obliquata obliquata_)
E	Catspaw, white (pearlymussel) (_Epioblasma obliquata perobliqua_)
E	Clubshell Entire Range; Except where listed as Experimental Populations (_Pleurobema clava_)
E	Dragonfly, Hine's emerald (_Somatochlora hineana_)
T	Eagle, bald (lower 48 States) (_Haliaeetus leucocephalus_)
E	Fanshell (_Cyprogenia stegaria_)
E	Madtom, Scioto (_Noturus trautmani_)
E	Mucket, pink (pearlymussel) (_Lampsilis abrupta_)
E	Plover, piping (Great Lakes watershed) (_Charadrius melodus_)
T	Plover, piping (except Great Lakes watershed) (_Charadrius melodus_)
E	Puma (=cougar), eastern (_Puma (=Felis) concolor couguar_)
E	Riffleshell, northern (_Epioblasma torulosa rangiana_)
T	Snake, copperbelly water (MI, OH, IN N of 400 N. Lat.) (_Nerodia erythrogaster neglecta_)
T	Snake, Lake Erie water (subspecies range clarified) (_Nerodia sipedon insularum_)
T	Wolf, gray Eastern Distinct Population Segment (_Canis lupus_)
Plants -- 6
Status	Listing
T	Monkshood, northern wild (_Aconitum noveboracense_)
T	Daisy, lakeside (_Hymenoxys herbacea_)
T	Pogonia, small whorled (_Isotria medeoloides_)
T	Orchid, eastern prairie fringed (_Platanthera leucophaea_)
T	Spiraea, Virginia (_Spiraea virginiana_)
E	Clover, running buffalo (_Trifolium stoloniferum_)

Pennsylvania -- 17 listings
Animals – 14
Status	Listing
E	Bat, Indiana (_Myotis sodalis_)
E	Clubshell Entire Range; Except where listed as Experimental Populations (_Pleurobema clava_)
T	Eagle, bald (lower 48 States) (_Haliaeetus leucocephalus_)

E Mucket, pink (pearlymussel) (*Lampsilis abrupta*)
E Pearlymussel, cracking Entire Range; Except where listed as Experimental Populations (*Hemistena lata*)
E Pigtoe, rough (*Pleurobema plenum*)
E Pimpleback, orangefoot (pearlymussel) (*Plethobasus cooperianus*)
E Plover, piping (Great Lakes watershed) (*Charadrius melodus*)
E Puma (=cougar), eastern (*Puma (=Felis) concolor couguar*)
E Riffleshell, northern (*Epioblasma torulosa rangiana*)
E Ring pink (mussel) (*Obovaria retusa*)
T Turtle, bog (=Muhlenberg) (northern) (*Clemmys muhlenbergii*)
E Wedgemussel, dwarf (*Alasmidonta heterodon*)
T Wolf, gray Eastern Distinct Population Segment (*Canis lupus*)

Plants -- 3

Status Listing
T Pogonia, small whorled (*Isotria medeoloides*)
E Bulrush, Northeastern (*Scirpus ancistrochaetus*)
T Spiraea, Virginia (*Spiraea virginiana*)\

Rhode Island -- 17 listings

Animals – 15

Status Listing
E Beetle, American burying (*Nicrophorus americanus*)
T Eagle, bald (lower 48 States) (*Haliaeetus leucocephalus*)
T Plover, piping (except Great Lakes watershed) (*Charadrius melodus*)
E Puma (=cougar), eastern (*Puma (=Felis) concolor couguar*)
E Sea turtle, hawksbill (*Eretmochelys imbricata*)
E Sea turtle, Kemp's ridley (*Lepidochelys kempii*)
E Sea turtle, leatherback (*Dermochelys coriacea*)
T Sea turtle, loggerhead (*Caretta caretta*)
E Sturgeon, shortnose (*Acipenser brevirostrum*)
E Tern, roseate (northeast U.S. nesting pop.) (*Sterna dougallii dougallii*)
T Tiger beetle, northeastern beach (*Cicindela dorsalis dorsalis*)
E Whale, finback (*Balaenoptera physalus*)
E Whale, humpback (*Megaptera novaeangliae*)
E Whale, right (*Balaena glacialis (incl. australis)*)
T Wolf, gray Eastern Distinct Population Segment (*Canis lupus*)

Plants -- 2

Status Listing
E Gerardia, sandplain (*Agalinis acuta*)
T Pogonia, small whorled (*Isotria medeoloides*)

South Carolina -- 42 listings

Animals -- 22

Status Listing
T(S/A) Alligator, American (*Alligator mississippiensis*)
E Bat, Indiana (*Myotis sodalis*)
T Eagle, bald (lower 48 States) (*Haliaeetus leucocephalus*)
E Heelsplitter, Carolina (*Lasmigona decorata*)
T Plover, piping (except Great Lakes watershed) (*Charadrius melodus*)
E Puma (=cougar), eastern (*Puma (=Felis) concolor couguar*)
T Salamander, flatwoods (*Ambystoma cingulatum*)
T Sea turtle, green (except where endangered) (*Chelonia mydas*)
E Sea turtle, hawksbill (*Eretmochelys imbricata*)
E Sea turtle, Kemp's ridley (*Lepidochelys kempii*)
E Sea turtle, leatherback (*Dermochelys coriacea*)
T Sea turtle, loggerhead (*Caretta caretta*)
T Snake, eastern indigo (*Drymarchon corais couperi*)
E Stork, wood (AL, FL, GA, SC) (*Mycteria americana*)
E Sturgeon, shortnose (*Acipenser brevirostrum*)
T Tern, roseate (Western Hemisphere except NE U.S.) (*Sterna dougallii dougallii*)
T(S/A) Turtle, bog (=Muhlenberg) (southern) (*Clemmys muhlenbergii*)
E Whale, finback (*Balaenoptera physalus*)
E Whale, humpback (*Megaptera novaeangliae*)

E	Whale, right (*Balaena glacialis (incl. australis)*)
E	Wolf, red (except where XN) (*Canis rufus*)
E	Woodpecker, red-cockaded (*Picoides borealis*)

Plants -- 20

Status	Listing
T	Amaranth, seabeach (*Amaranthus pumilus*)
T	Amphianthus, little (*Amphianthus pusillus*)
E	Coneflower, smooth (*Echinacea laevigata*)
E	Sunflower, Schweinitz's (*Helianthus schweinitzii*)
T	Pink, swamp (*Helonias bullata*)
T	Heartleaf, dwarf-flowered (*Hexastylis naniflora*)
E	Quillwort, black spored (*Isoetes melanospora*)
T	Pogonia, small whorled (*Isotria medeoloides*)
E	Pondberry (*Lindera melissifolia*)
E	Loosestrife, rough-leaved (*Lysimachia asperulaefolia*)
E	Dropwort, Canby's (*Oxypolis canbyi*)
E	Harperella (*Ptilimnium nodosum*)
E	Sumac, Michaux's (*Rhus michauxii*)
T	Gooseberry, Miccosukee (*Ribes echinellum*)
E	Arrowhead, bunched (*Sagittaria fasciculata*)
E	Pitcher-plant, mountain sweet (*Sarracenia rubra ssp. jonesii*)
E	Chaffseed, American (*Schwalbea americana*)
E	Irisette, white (*Sisyrinchium dichotomum*)
E	Trillium, persistent (*Trillium persistens*)
E	Trillium, relict (*Trillium reliquum*)

Tennessee -- 96 listings

Animals – 76

Status	Listing
E	Acornshell, southern (*Epioblasma othcaloogensis*)
E	Bat, gray (*Myotis grisescens*)
E	Bat, Indiana (*Myotis sodalis*)
E	Bean, Cumberland (pearlymussel) Entire Range; Except where listed as Experimental Populations (*Villosa trabalis*)
XN	Bean, Cumberland (pearlymussel) AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Villosa trabalis*)
E	Bean, purple (*Villosa perpurpurea*)
E	Blossom, green (pearlymussel) (*Epioblasma torulosa gubernaculum*)
E	Blossom, tubercled (pearlymussel) Entire Range; Except where listed as Experimental Populations (*Epioblasma torulosa torulosa*)
XN	Blossom, tubercled (pearlymussel) AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Epioblasma torulosa torulosa*)
E	Blossom, turgid (pearlymussel) Entire Range; Except where listed as Experimental Populations (*Epioblasma turgidula*)
XN	Blossom, turgid (pearlymussel) AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Epioblasma turgidula*)
E	Blossom, yellow (pearlymussel) Entire Range; Except where listed as Experimental Populations (*Epioblasma florentina florentina*)
XN	Blossom, yellow (pearlymussel) AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Epioblasma florentina florentina*)
E	Catspaw (=purple cat's paw pearlymussel) Entire Range; Except where listed as Experimental Populations (*Epioblasma obliquata obliquata*)
XN	Catspaw (=purple cat's paw pearlymussel) AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Epioblasma obliquata obliquata*)
T	Chub, slender (*Erimystax cahni*)
T	Chub, spotfin Entire (*Cyprinella monacha*)
E	Combshell, Cumberlandian Entire Range; Except where listed as Experimental Populations (*Epioblasma brevidens*)
XN	Combshell, Cumberlandian AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Epioblasma brevidens*)
E	Combshell, upland (*Epioblasma metastriata*)
E	Crayfish, Nashville (*Orconectes shoupi*)

T Dace, blackside (*Phoxinus cumberlandensis*)
E Darter, amber (*Percina antesella*)
E Darter, bluemask (=jewel) (*Etheostoma /*)
E Darter, boulder (*Etheostoma wapiti*)
E Darter, duskytail Entire (*Etheostoma percnurum*)
T Darter, slackwater (*Etheostoma boschungi*)
T Darter, snail (*Percina tanasi*)
T Eagle, bald (lower 48 States) (*Haliaeetus leucocephalus*)
E Elktoe, Appalachian (*Alasmidonta raveneliana*)
E Elktoe, Cumberland (*Alasmidonta atropurpurea*)
E Fanshell (*Cyprogenia stegaria*)
E Kidneyshell, triangular (*Ptychobranchus greeni*)
E Lampmussel, Alabama Entire Range; Except where listed as Experimental Populations (*Lampsilis virescens*)
E Lilliput, pale (pearlymussel) (*Toxolasma cylindrellus*)
E Logperch, Conasauga *Percina jenkinsi*)
E Madtom, pygmy (*Noturus stanauli*)
E Madtom, smoky Entire (*Noturus baileyi*)
XN Madtom, yellowfin Holston River, VA, TN (*Noturus flavipinnis*)
T Madtom, yellowfin (except where XN) (*Noturus flavipinnis*)
E Mapleleaf, winged (mussel) Entire; except where listed as experimental populations (*Quadrula fragosa*)
E Marstonia, royal (snail) (*Pyrgulopsis ogmorhaphe*)
E Moccasinshell, Coosa (*Medionidus parvulus*)
E Monkeyface, Appalachian (pearlymussel) (*Quadrula sparsa*)
E Monkeyface, Cumberland (pearlymussel) Entire Range; Except where listed as Experimental Populations (*Quadrula intermedia*)
XN Monkeyface, Cumberland (pearlymussel) AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Quadrula intermedia*)
E Mucket, pink (pearlymussel) (*Lampsilis abrupta*)
E Mussel, oyster Entire Range; Except where listed as Experimental Populations (*Epioblasma capsaeformis*)
XN Mussel, oyster AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Epioblasma capsaeformis*)
E Pearlymussel, birdwing Entire Range; Except where listed as Experimental Populations (*Conradilla caelata*)
E Pearlymussel, cracking Entire Range; Except where listed as Experimental Populations (*Hemistena lata*)
E Pearlymussel, dromedary Entire Range; Except where listed as Experimental Populations (*Dromus dromas*)
E Pearlymussel, littlewing (*Pegias fabula*)
E Pigtoe, Cumberland (*Pleurobema gibberum*)
E Pigtoe, finerayed Entire Range; Except where listed as Experimental Populations (*Fusconaia cuneolus*)
XN Pigtoe, finerayed AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Fusconaia cuneolus*)
E Pigtoe, rough (*Pleurobema plenum*)
E Pigtoe, shiny Entire Range; Except where listed as Experimental Populations (*Fusconaia cor*)
XN Pigtoe, shiny AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Fusconaia cor*)
E Pigtoe, southern (*Pleurobema georgianum*)
E Pimpleback, orangefoot (pearlymussel) (*Plethobasus cooperianus*)
T Pocketbook, finelined (*Lampsilis altilis*)
E Puma (=cougar), eastern (*Puma (=Felis) concolor couguar*)
E Rabbitsfoot, rough (*Quadrula cylindrica strigillata*)
E Riffleshell, tan (*Epioblasma florentina walkeri (=E. walkeri)*)
E Ring pink (mussel) (*Obovaria retusa*)
E Riversnail, Anthony's Entire Range; Except where listed as Experimental Populations (*Athearnia anthonyi*)
XN Riversnail, Anthony's AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Athearnia anthonyi*)
T Shiner, blue (*Cyprinella caerulea*)
T Snail, painted snake coiled forest (*Anguispira picta*)
E Spider, spruce-fir moss (*Microhexura montivaga*)
E Squirrel, Carolina northern flying (*Glaucomys sabrinus coloratus*)
E Sturgeon, pallid (*Scaphirhynchus albus*)
E Tern, least (interior pop.) (*Sterna antillarum*)
E Wartyback, white (pearlymussel) (*Plethobasus cicatricosus*)
XN Wolf, red [XN] (*Canis rufus*)

Plants -- 20

Status	Listing
T	Potato-bean, Price's (*Apios priceana*)
E	Rock-cress, Braun's (*Arabis perstellata*)
E	Sandwort, Cumberland (*Arenaria cumberlandensis*)
T	Fern, American hart's-tongue (*Asplenium scolopendrium* var. *americanum*)
E	Ground-plum, Guthrie's (=Pyne's) (*Astragalus bibullatus*)
T	Rosemary, Cumberland (*Conradina verticillata*)
E	Prairie-clover, leafy (*Dalea foliosa*)
E	Coneflower, Tennessee purple (*Echinacea tennesseensis*)
E	Avens, spreading (*Geum radiatum*)
E	Lichen, rock gnome (*Gymnoderma lineare*)
E	Bluet, Roan Mountain (*Hedyotis purpurea* var. *montana*)
T	Sunflower, Eggert's (*Helianthus eggertii*)
T	Pogonia, small whorled (*Isotria medeoloides*)
E	Bladderpod, Spring Creek (*Lesquerella perforata*)
E	Aster, Ruth's golden (*Pityopsis ruthii*)
E	Pitcher-plant, green (*Sarracenia oreophila*)
T	Skullcap, large-flowered (*Scutellaria montana*)
T	Goldenrod, Blue Ridge (*Solidago spithamaea*)
T	Spiraea, Virginia (*Spiraea virginiana*)
E	Grass, Tennessee yellow-eyed (*Xyris tennesseensis*)

Vermont -- 8 listings

Animals – 6

Status	Listing
E	Bat, Indiana (*Myotis sodalis*)
T	Eagle, bald (lower 48 States) (*Haliaeetus leucocephalus*)
E	Puma (=cougar), eastern (*Puma (=Felis) concolor couguar*)
T	Tiger beetle, Puritan (*Cicindela puritana*)
E	Wedgemussel, dwarf (*Alasmidonta heterodon*)
T	Wolf, gray Eastern Distinct Population Segment (*Canis lupus*)

Plants -- 2

Status	Listing
E	Milk-vetch, Jesup's (*Astragalus robbinsii* var. *jesupi*)
E	Bulrush, Northeastern (*Scirpus ancistrochaetus*)

Virginia -- 71 listings

Animals -- 56

Status	Listing
E	Bat, gray (*Myotis grisescens*)
E	Bat, Indiana (*Myotis sodalis*)
E	Bat, Virginia big-eared (*Corynorhinus (=Plecotus) townsendii virginianus*)
XN	Bean, Cumberland (pearlymussel) AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Villosa trabalis*)
E	Bean, purple (*Villosa perpurpurea*)
E	Blossom, green (pearlymussel) (*Epioblasma torulosa gubernaculum*)
T	Chub, slender (*Erimystax cahni*)
T	Chub, spotfin Entire (*Cyprinella monacha*)
E	Combshell, Cumberlandian Entire Range; Except where listed as Experimental Populations (*Epioblasma brevidens*)
XN	Combshell, Cumberlandian AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Epioblasma brevidens*)
E	Darter, duskytail Entire (*Etheostoma percnurum*)
T	Eagle, bald (lower 48 States) (*Haliaeetus leucocephalus*)
E	Fanshell (*Cyprogenia stegaria*)
E	Isopod, Lee County cave (*Lirceus usdagalun*)
T	Isopod, Madison Cave (*Antrolana lira*)
E	Logperch, Roanoke (*Percina rex*)
XN	Madtom, yellowfin Holston River, VA, TN (*Noturus flavipinnis*)
T	Madtom, yellowfin (except where XN) (*Noturus flavipinnis*)
E	Monkeyface, Appalachian (pearlymussel) (*Quadrula sparsa*)

E Monkeyface, Cumberland (pearlymussel) Entire Range; Except where listed as Experimental Populations (*Quadrula intermedia*)
XN Monkeyface, Cumberland (pearlymussel) AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Quadrula intermedia*)
E Mucket, pink (pearlymussel) (*Lampsilis abrupta*)
E Mussel, oyster Entire Range; Except where listed as Experimental Populations (*Epioblasma capsaeformis*)
XN Mussel, oyster AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Epioblasma capsaeformis*)
E Pearlymussel, birdwing Entire Range; Except where listed as Experimental Populations (*Conradilla caelata*)
E Pearlymussel, cracking Entire Range; Except where listed as Experimental Populations (*Hemistena lata*)
E Pearlymussel, dromedary Entire Range; Except where listed as Experimental Populations (*Dromus dromas*)
E Pearlymussel, littlewing (*Pegias fabula*)
E Pigtoe, finerayed Entire Range; Except where listed as Experimental Populations (*Fusconaia cuneolus*)
XN Pigtoe, finerayed AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Fusconaia cuneolus*)
E Pigtoe, rough (*Pleurobema plenum*)
E Pigtoe, shiny Entire Range; Except where listed as Experimental Populations (*Fusconaia cor*)
XN Pigtoe, shiny AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Fusconaia cor*)
T Plover, piping (except Great Lakes watershed) (*Charadrius melodus*)
E Puma (=cougar), eastern (*Puma (=Felis) concolor couguar*)
E Rabbitsfoot, rough (*Quadrula cylindrica strigillata*)
E Riffleshell, tan (*Epioblasma florentina walkeri (=E. walkeri)*)
E Salamander, Shenandoah (*Plethodon shenandoah*)
T Sea turtle, green (except where endangered) (*Chelonia mydas*)
E Sea turtle, hawksbill (*Eretmochelys imbricata*)
E Sea turtle, Kemp's ridley (*Lepidochelys kempii*)
E Sea turtle, leatherback (*Dermochelys coriacea*)
T Sea turtle, loggerhead (*Caretta caretta*)
E Snail, Virginia fringed mountain (*Polygyriscus virginianus*)
E Spinymussel, James (*Pleurobema collina*)
E Squirrel, Delmarva Peninsula fox (except Sussex Co., DE) (*Sciurus niger cinereus*)
E Squirrel, Virginia northern flying (*Glaucomys sabrinus fuscus*)
E Sturgeon, shortnose (*Acipenser brevirostrum*)
E Tern, roseate (northeast U.S. nesting pop.) (*Sterna dougallii dougallii*)
T Tiger beetle, northeastern beach (*Cicindela dorsalis dorsalis*)
T(S/A) Turtle, bog (=Muhlenberg) (southern) (*Clemmys muhlenbergii*)
E Wedgemussel, dwarf (*Alasmidonta heterodon*)
E Whale, finback (*Balaenoptera physalus*)
E Whale, humpback (*Megaptera novaeangliae*)
E Whale, right (*Balaena glacialis (incl. australis)*)
E Woodpecker, red-cockaded (*Picoides borealis*)

Plants -- 15

Status	Listing
T	Joint-vetch, sensitive (*Aeschynomene virginica*)
T	Amaranth, seabeach (*Amaranthus pumilus*)
E	Rock-cress, shale barren (*Arabis serotina*)
T	Birch, Virginia round-leaf (*Betula uber*)
E	Bittercress, small-anthered (*Cardamine micranthera*)
E	Coneflower, smooth (*Echinacea laevigata*)
T	Sneezeweed, Virginia (*Helenium virginicum*)
T	Pink, swamp (*Helonias bullata*)
E	Mallow, Peter's Mountain (*Iliamna corei*)
T	Pogonia, small whorled (*Isotria medeoloides*)
T	Orchid, eastern prairie fringed (*Platanthera leucophaea*)
E	Harperella (*Ptilimnium nodosum*)
E	Sumac, Michaux's (*Rhus michauxii*)
E	Bulrush, Northeastern (*Scirpus ancistrochaetus*)
T	Spiraea, Virginia (*Spiraea virginiana*)

West Virginia -- 21 listings

Animals – 15

Appendix C

Status	Listing
E	Bat, gray (*Myotis grisescens*)
E	Bat, Indiana (*Myotis sodalis*)
E	Bat, Virginia big-eared (*Corynorhinus (=Plecotus) townsendii virginianus*)
E	Blossom, tubercled (pearlymussel) Entire Range; Except where listed as Experimental Populations (*Epioblasma torulosa torulosa*)
XN	Blossom, tubercled (pearlymussel) AL; Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL (*Epioblasma torulosa torulosa*)
E	Clubshell Entire Range; Except where listed as Experimental Populations (*Pleurobema clava*)
T	Eagle, bald (lower 48 States) (*Haliaeetus leucocephalus*)
E	Fanshell (*Cyprogenia stegaria*)
E	Mucket, pink (pearlymussel) (*Lampsilis abrupta*)
E	Puma (=cougar), eastern (*Puma (=Felis) concolor couguar*)
E	Riffleshell, northern (*Epioblasma torulosa rangiana*)
T	Salamander, Cheat Mountain (*Plethodon nettingi*)
T	Snail, flat-spired three-toothed (*Triodopsis platysayoides*)
E	Spinymussel, James (*Pleurobema collina*)
E	Squirrel, Virginia northern flying (*Glaucomys sabrinus fuscus*)

Plants -- 6

Status	Listing
E	Rock-cress, shale barren (*Arabis serotina*)
T	Pogonia, small whorled (*Isotria medeoloides*)
E	Harperella (*Ptilimnium nodosum*)
E	Bulrush, Northeastern (*Scirpus ancistrochaetus*)
T	Spiraea, Virginia (*Spiraea virginiana*)
E	Clover, running buffalo (*Trifolium stoloniferum*)

APPENDIX D
SUMMARY OF STATE-LISTED SPECIES

IN STATES PROPOSED FOR APHIS-WS CONTINUED OR EXPANDED INVOLVEMENT IN ORAL RABIES VACCINATION PROGRAMS

Number of State Listed Species by Category
(Species for which concerns about ORV programs might be raised are identified and shown in bold)
Information obtained from http://training.fws.gov/IAFWA/mat/website/statelinks.html in March, 2005

State	Mammals	Birds	Reptiles	Amphibians	Fish	Invertebrates	Plants
Alabama	9NG **long-tailed weasel**	19NG	13NG	8NG	23NG	32E, 10T	11E, 7T
Connecticut	2E, 9SC **gray wolf, eastern puma**	21E, 9T, 20SC	4E, 3T, 4SC	1E, 3T, 3SC	3E, 2T, 2SC	17E, 24T, 128SC	119E, 38T, 186SC
Delaware	1E **Delmarva fox squirrel**	24E	6E	2E	1E	15E	
Florida	20E, 4T, 6SSC **Florida black bear, Everglades mink, Florida panther, Sherman's fox squirrel, Lower Keys marsh rabbit, Big Cypress fox squirrel**	8E, 10T, 18SSC	6E, 10T, 8SSC	5 SSC	3E, 2T, 10 SSC	4E, 4SSC	335E, 67T
Georgia	7E, 1T, 1R **eastern puma, Florida panther, round-tailed muskrat**	6E, 2T, 7R	3E, 7T, 2R, 1U	2T, 5R	16E, 18T, 19R, 2U	13E, 4T	38E, 49T, 12R, 7U
Indiana	10E, 12SC **American badger, bobcat, northern river otter, least weasel**	28E, 11SC	15E, 2SC	5E, 5SC	12E, 8SC	15E, 11SC	208E, 90T, 107R
Kentucky	5E, 3T, 3SC **American black bear, eastern spotted skunk, least weasel**	19E, 10T, 16SC	3E, 8T, 7SC	1E, 5T, 9SC	27E, 13T, 16SC	28E, 9T, 12SC	155E, 5T
Louisiana	7E, 1 T **Louisiana black bear, Florida panther, red wolf**	9E, 2T	3E, 4T, 2C	1E	1E, 1T, 2C	4E, 1T	2E, 1T
Maine	1T	9E, 6T	3E, 2T	0	1T	6E,6T	88E, 98T, 105SC

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Maryland	11E, 7I **North American porcupine, bobcat, least weasel, Delmarva fox squirrel, New England cottontail**	14E, 4T, 8I	7E, 3T, 1I	5E, 1T, 2I	6E, 7T, 3I	27E, 5T, 8I	265E, 79T
Massachusetts	7E, 4SC	12E, 6T, 10SC	8E, 5T, 3SC	2T, 4SC	4E, 2T, 4SC	29E, 25T, 58SC	61E, 32T, 11SC
Michigan	4E, 2T, 4SC **eastern puma, Canada lynx, gray wolf**	8E, 13T, 21SC	2E, 2T, 6SC	1E, 1T, 2SC	8E, 7T, 11SC	19E, 15T, 110SC	31E, 210T, 110SC
Mississippi	6E **American black bear, Louisiana black bear, Florida panther**	12E	14E	5E	15E	25E	4E
New Hampshire	2E, 1T **Canada lynx, American marten**	12E, 7T	1E, 1T	1E	2E	6E, 3T	130E, 146T, 11C
New Jersey	9E **bobcat**	17E, 16T	8E, 3T	3E, 3T	1E	9E, 8T	0
New York	10E, 1T, 3SC **Canada lynx, New England cottontail, gray wolf, eastern puma**	10E, 10T, 19SC	7E, 5T, 6SC	2E, 7SC	8E, 11T, 5SC	16E, 8T, 18SC	4E, 7T
North Carolina	6E, 2T, 11SC **eastern puma, Carolina northern flying squirrel**	8E, 4T, 16SC	5E, 4T, 11SC	1E, 4T, 12SC	9E, 13T, 27SC	23E, 20T, 38SC	96E, 45T, 20SC
Ohio	5E, 8SC **bobcat, snowshoe hare, American black bear, ermine, American badger**	19E, 8T, 13SC, 30SI	5E, 2T, 8 SC	5E, 1T, 1 SC	24E, 13T, 9SC	70E, 23T, 51SC, 11SI	253E, 162T
Pennsylvania	3E, 3T **Delmarva fox squirrel**	11E, 5T	3E, 2T	3E, 1T	8E, 10T	2SC	13E, 5T
Rhode Island	1T, 5C **bobcat**	7E, 8T, 36C	3E, 2T, 5C	1T, 2C	1C	1E, 3T, 48C	51E, 57T, 139C
South Carolina	3E, 1T, 24SC **American black bear, eastern fox squirrel, New**	6E, 2T, 11SC	1E, 4T, 12SC	3E, 2T, 11SC	1E, 1T, 9SC	1E, 8SC	14E, 6T, 462SC

	England cottontail, eastern spotted skunk, swamp rabbit						
Tennessee	3E, 14SM **Carolina northern flying squirrel**	4E, 4T, 21SM	3T, 4SM	1T, 10SM	20E, 17T, 40SM	51E, 4T, 1SM	196E, 133T, 186S
Vermont	4E, 1T, 4SC **Canada lynx, eastern cougar, American marten, New England cottontail**	9E, 3T, 19SC	3E, 1T, 6SC	1E, 5SC	4E, 2T, 12SC	8E, 6T, 12SC	61E, 90T
Virginia	18E, 1T, 3SC **Delmarva fox squirrel, eastern puma, gray wolf, snowshoe hare, Virginia northern flying squirrel, marsh rabbit, northern river otter**	6E, 8T, 31SC	6E, 4T, 1SC	1T, 9SC	7E, 13T, 17SC	36E, 12T, 18SC	56E, 28T, 11SC
West Virginia	6S1, 11S2, 5S3 **West Virginia northern flying squirrel, eastern spotted skunk, Appalachian cottontail**	28S1, 15S2, 15S3	3S1, 9S2, 6S3	6S1, 7S2, 5S3	26S1, 26S2, 20S3	173S1, 80S2, 26S3	267S1, 136S2, 27S3

C=Candidate Species for Listing as Threatened or Endangered; NG=Nongame Species Regulation; ISP=Invertebrate Species Regulation; SSC or SC=Species of Concern or Special Concern; SI="Special Interest" Species; PEx=Possibly Extirpated; E=State Endangered; T=State Threatened; SM=Species in Need of Management; I=In need of Conservation; R=Rare; U=Unusual; S1, S2, or S3=WV designations for levels of concern.

State	T&E Protections under State Law
Alabama	no state threatened or endangered status; certain listed "nongame" species given special protection against "take"; "take" not specifically defined
Connecticut	it is unlawful for (1) any person to willfully take any endangered or threatened species on or from public property, waters of the state, or property of another without the written permission of the owner on whose property the species occurs; (2) any person, including the owner of the land on which an endangered or threatened species occurs, to willfully take an endangered or threatened species for the purpose of selling, offering for sale, transporting for commercial gain or exporting such specimen; (3) any state agency to destroy or adversely modify essential habitat designated pursuant to section 26-306, so as to reduce the viability of the habitat to support endangered or threatened species or so as to kill, injure, or appreciably reduce the likelihood of survival of the species.
Delaware	the Division may designate species of fish and wildlife that are seriously threatened with extinction as endangered species

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Florida	unlawful to "capture" endangered or to "take" threatened species without permit.
Georgia	species are listed as endangered, threatened, rare or unusual and are given this status under the Georgia Endangered wildlife Act of 1973.
Indiana	vertebrates, mollusks, and crustaceans classified as endangered in Indiana are protected from taking pursuant to the Nongame and Endangered Species Act of 1973 and Fish and Wildlife Administrative Rules
Kentucky	state laws define "take" for state-listed endangered species similar to ESA; state threatened, species of concern, and historical biota have no special additional protection
Louisiana	the state should assist in the protection of species of wildlife which are determined to be "threatened" or "endangered" elsewhere pursuant to the Federal Endangered Species Act, as concurred by the Louisiana Wildlife and Fisheries Commission, by prohibiting the taking, possession, transportation, exportation from the state, processing, sale or offer for sale or shipment within this state of such endangered species, or by carefully regulating such activities with regard to such species
Maine	unlawful to "hunt, take or trap" any endangered or threatened species without a permit issued for specific action by the commissioner or the state of Maine
Maryland	state law defines "take" similar to ESA; endangered and threatened categories have protections against "take"
Massachusetts	"take" defined similar to ESA; threatened, endangered, and "special concern" categories have equal protections against "take"
Michigan	a person shall not take, possess, transport, import, export, process, sell, offer for sale, buy, or offer to buy, and a common or contract carrier shall not transport or receive for shipment, any species of fish, plants, or wildlife on the following lists: (a) The list of fish, plants, and wildlife indigenous to the state determined to be endangered or threatened within the state pursuant to section 36503 or subsection (3). (b) The United States list of endangered or threatened native fish and wildlife. (c) The United States list of endangered or threatened plants. (d) The United States list of endangered or threatened foreign fish and wildlife
Mississippi	All birds of prey (eagles, hawks, osprey, owls, kites and vultures) and other nongame birds are protected and may not be hunted, molested, bought or sold. English sparrows, starlings, blackbirds and crows may be taken according to regulations. The following endangered species are also protected: black bear, Florida panther, gray bat, Indiana bat, all sea turtles, gopher tortoise, sawback turtles (black-knobbed, ringed, yellow-blotched), black pine snake, eastern indigo snake, rainbow snake, and the southern hognose snake
New Hampshire	With respect to any endangered or threatened species, it is unlawful to: (a) Export any such species from this state; (b) Take any such species within this state; (c) Possess, process, sell or offer for sale, deliver, carry, transport or ship, by any means whatsoever, any such species; (d) Violate any rule adopted under this chapter pertaining to the conservation of such species of wildlife listed pursuant to RSA 212-A:6, IV
New Jersey	unlawful to "take" any endangered species of fish or wildlife; "take" defined similar to ESA; no exemptions or permits to allow for incidental take
New York	endangered and threatened categories have protections against "take"; "special concern" category has no special additional protection
North Carolina	unlawful to take or possess any endangered, threatened, or special concern species at any time without the appropriate permit

Ohio	unlawful to "take" any endangered species of fish or wildlife; "take" not specifically defined; no exemptions or permits to allow for incidental take; no special protections for "threatened" or "special interest" species; APHIS-WS advised to just release any state listed species if captured or to report accidental mortality
Pennsylvania	endangered and threatened categories have protections against "take"
Rhode Island	no person shall buy, sell, offer for sale, store, transport, import, export, or otherwise traffic in any animal or plant or any part of any animal or plant whether living, dead, processed, manufactured, preserved, or raw if the animal or plant has been declared to be an endangered species by either the United States secretaries of the interior or commerce or the director of the Rhode Island department of environmental management; exception is for purposes of scientific research or educational display either of which must be done by or under the formal supervision of a legitimate college or university and then only upon the issuance of a special permit for each individual excepted species
South Carolina	unlawful to take, possess, transport, export, process, sell or ship wildlife in need of management except as otherwise provided
Tennessee	unlawful to take, possess, transport, export or ship any endangered or threatened species without permit; regulations allow provisions for "take" to alleviate damage and to protect human health and safety
Vermont	unlawful to "take" any endangered or threatened species without the issuance of a permit; "take" not specifically defined; state law includes all federally listed species as state listed
Virginia	unlawful to "take" any endangered or threatened species of fish or wildlife; "take" defined same as federal ESA; no exemptions or permits to allow for incidental take
West Virginia	only lists federal T&E species as having protections; "Species of Concern" are listed, but have no legal status other than those that are already federally listed

APPENDIX E
ECOREGION DESIGNATIONS

WITHIN STATES AFFECTED BY APHIS-WS CONTINUED OR EXPANDED INVOLVEMENT IN ORAL RABIES VACCINATION PROGRAMS

Ecoregions are ecosystems of regional extent as defined by Bailey (1995). An "X" means the state contains the ecosystem/ecoregion described in the key below. The reader is referred to Bailey (1995) for more detailed descriptions of each ecoregion and the climate, soils, vegetation, and animal life that occur there.

State	212	M212	221	222	M221	231	232	234	251	411
Maine	X	X	X							
New Hampshire		X	X							
Vermont	X	X								
Massachusetts		X	X							
Connecticut		X	X							
Rhode Island			X							
New York	X	X	X	X						
Pennsylvania	X		X		X					
Ohio			X	X						
Michigan	X			X						
Indiana				X					X	
New Jersey			X							
Maryland			X		X	X	X			
Delaware							X			
West Virginia			X		X					
Virginia			X		X	X	X			
Kentucky			X	X	X			X		
Tennessee			X	X	X	X		X		
North Carolina					X	X	X			
South Carolina					X	X	X			
Georgia			X		X	X	X			
Alabama			X	X		X	X			
Florida							X			X
Mississippi						X	X	X		
Louisiana						X	X	X		

Appendix E

Key to Ecoregion Designations (adapted from descriptions by Bailey 1995):

Numbers in the 200 series are within the "Humid Temperate Domain":

212	Laurentian Mixed Forest Province – lower elevation areas (sea level to 2,400 ft.), flat to rolling hills in relief, moderately long and severe winters; native vegetation types are transitional between spruce-fir coniferous boreal forest and broadleaf deciduous forest zones and are characterized by mixed stands of coniferous (mainly pine) species and a few deciduous species (mainly yellow birch, sugar maple, and American beech); in some areas, other tree species include hemlock, red cedar.
M212	Adirondack-New England Mixed Forest-Coniferous Forest-Alpine Meadow Province – mountainous region with elevations between 500 and 4000 ft.; warm summers and sometimes cold winters; native vegetation types transitional between boreal spruce-fir coniferous forest to the north and deciduous forest to the south; valleys contain hardwood forest (sugar maple, yellow birch, beech, hemlock), lower mountain slopes with mixed forest of spruce, fir, maple, beech, and birch, and higher elevations with fir and spruce.
221	Eastern Broadleaf Forest (Oceanic) Province – diverse topography; elevations from 1000 to 3000 ft.; cold winters and warm summers; native vegetation characterized by temperate deciduous forest dominated by tall broadleaf trees that provide a dense, continuous canopy in summer and shed their leaves in winter; dominant deciduous species include American beech, yellow-poplar, basswoods, sugar maple, buckeye, red oak, white oak, hemlock; includes areas of pine-oak forest ("Pine Barrens").
222	Eastern Broadleaf Forest (Continental) Province – flat to rolling to moderate in relief; elevations from 80 to 1,650 ft.; hot summers; native vegetation dominated by broadleaf deciduous forest with oak and hickory tree species more abundant than in other provinces; gradually turns more to prairie towards the Midwest, forming a mosaic pattern with prairie.
M221	Central Appalachian Broadleaf Forest - Coniferous Forest - Meadow Province – low mountains at elevations ranging from 300 to 6,700 ft.; distinct summers and winters; native vegetation characterized by mixed oak-pine forest, dominated by the white and black oak groups at lower levels; northeastern hardwood forest at mid elevation levels, and spruce-fir forest and meadows on the highest peaks.
231	Southeastern Mixed Forest Province – comprised of the Piedmont and irregular Gulf Coastal Plains with elevations from 100 to 1000 feet and flat to gentle sloping relief; mild winters, hot humid summers; native vegetation comprised of broadleaf deciduous (oak, hickory, sweetgum, red maple, winged elm) and needleleaf evergreen trees (mostly loblolly pine, shortleaf pine, other southern yellow pine species).
232	Outer Coastal Plain Mixed Forest Province – flat and irregular Atlantic and Gulf Coastal Plains areas; flat to gentle sloping to gentle rolling in relief; temperatures relatively steady across seasons; native vegetation comprised of temperate rainforest characterized by evergreen oaks and members of the laurel and magnolia families, with coastal marshes and interior swamps dominated by gum and cypress tree species; most upland areas covered by subclimax pine forest.
234	Lower Mississippi Riverine Forest Province – flat to gently sloping broad floodplain and low terraces made up of alluvium and loess; from near sea level in the south, altitude increases gradually to about 660 feet in the north; land of oxbow lakes and swamps are significant in the extreme southern portion of the province; warm winters and hot summers; rain falls throughout the year, with a minimum in autumn; temperature and precipitation decrease heading north; native vegetation comprised of bottom-land deciduous forest, with ash, elm, cottonwood, sugarberry, sweetgum, water tupelo, oak, bald cypress, and vines significant

along water courses.

251 Prairie Parkland (Temperate) Province – gently rolling plains, but steep bluffs border a number of valleys; elevations range from 300 to 2,000 feet; characterized by hot summers and cold winters; average annual precipitation ranges from 20 to 40 inches; vegetation is considered forest-steppe with alternating prairie and deciduous forest; prairie is comprised predominantly of grasses and forests are comprised of oak and hickory.

Numbers in the 400 series are within the "Humid Tropical Domain":

411 Everglades Province – extensive low elevation (sea level to about 25 ft.) areas consisting primarily of large areas of swamps and marshes; hot summers and warm winters; native vegetation consists of tropical moist hardwood forest dominated by cypress trees and mangroves along the eastern and southern coasts; much open marsh characterized by grasses, reeds, sedges, and other aquatic herbaceous plants; some areas with dense stands of sawgrass and three-awn grasses.

APPENDIX F
AMERICAN INDIAN TRIBES LOCATED IN STATES THAT MAY BE AFFECTED BY APHIS-WS CONTINUED OR EXPANDED INVOLVEMENT IN ORV PROGRAMS

FEDERALLY RECOGNIZED TRIBES

Aroostook Band of Micmacs (ME)

Bay Mills Indian Community (MI)

Catawba Indian Tribe (SC)

Cayuga Nation of Nations (NY)

Chitimacha Indian Tribe (LA)

Coushatta Indian Tribe (LA)

Eastern Band of Cherokee Indians (NC)

Grand Traverse Band of Ottawa and Chippewa Indians (MI)

Hannahville Indian Community (MI)

Houlton Band of Maliseet Indians (ME)

Huron Potawatomi, Inc (MI)

Jena Band of Choctaw Indians (LA)

Keweenaw Bay Indian Community (MI)

Lac Vieux Desert Band of Lake Superior Chippewa (MI)

Little River Band of Ottawa Indians (MI)

Little Traverse Bay Bands of Odawa Indians (MI)

Mashantucket Pequot Tribal Nation (CT)

Match-e-be-nash-she-wish Band of Pottawatomi Indians (MI)

Miccosukee Indian Tribe (FL)

Mississippi Band of Choctaw Indians (MS)

Mohegan Indian Tribe (CT)

Narragansett Indian Tribe (RI)

Oneida Indian Nation (NY)

Onondaga Indian Nation (NY)

Passamaquoddy Tribe (ME)

Penobscot Indian Nation (ME)

Poarch Band of Creek Indians (AL)

Pokagon Band of Potawatomi Indians (MI)

Saginaw Chippewa Indian Tribe (MI)

Sault Ste. Marie Tribe of Chippewa Indians (MI)

Seminole Tribe (FL)

Seneca Nation of Indians (NY)

Schaghticoke Tribal Nation (CT)

St. Regis Mohawk Tribe (NY)

Tonawanda Band of Seneca (NY)

Tunica – Biloxi Tribe (LA)

Tuscarora Nation (NY)

Wampanoag Tribe of Gay Head (Aquinnah) (MA)

STATE RECOGNIZED TRIBES

Cherokees of SE Alabama

Cherokee Tribe of Northeast Alabama

Chickahominy Tribe (VA)

Coharie Intra-Tribal Council (NC)

Eastern Chickahominy (VA)

Echota Cherokee of Alabama

Gun Lake Village Band of Grand Lake Ottawa Indians (MI)

Haliwa-Saponi Tribe, Inc. (NC)

Hassanamisco Nipmuc (MA)

Langley Band of Chickamogee Cherokee Indians (AL)

Lumbee Tribal Council (NC)

Machis Lower Creek Indian (AL)

Mattiponi Indian Nation (VA)

Meherrin Indian Tribe (NC)

Monacan Indian Tribe (VA)

Nansemond Indian Tribal Association (VA)

Nanticoke Lenni-Lenape (NJ)

Oklevuaha Band of Yamassee Seminole (FL)

Pamunkey Nation (VA)

Paucatuck Eastern Pequot (CT)

Powhatan Renape Nation (NJ)

Ramapough Mountain Indians (NJ)

Schaghticoke Indian Tribe (CT)
Shinnecock Tribe (NY)

Star Clan of Muskogee Creeks of Pike County (AL)
United Houma Nation (LA)

United Rappahannock Tribe (VA)

United Remnant Band Shawnee Nation (OH)

Unkechaug Indian Nation of Poospatuck Indians (NY)

Upper Mataponi Tribe (VA)

Waccamaw-Siouan Development (NC)

APPENDIX G
USDA-AGRICULTURAL MARKETING SERVICE-NATIONAL ORGANICS PROGRAM RULE ON ORV BAIT DISTRIBUTION ON ORGANIC FARMS

USDA

United States Department of Agriculture

Agricultural Marketing Service

STOP 0268 – Room 4008-S
1400 Independence Avenue, SW.
Washington, D.C. 20250-0200

April 15, 2003

Ms. Wendy Servoss
Environmental Coordinator
USDA-APHIS-WS
6213-E Angus Drive
Raleigh, North Carolina 27617

Dear Ms. Servoss:

This is in response to your request that the National Organic Program (NOP) rule on whether the U.S. Department of Agriculture's (USDA), Animal and Plant Health Inspection Service, Wildlife Services (APHIS-WS) Oral Rabies Vaccination (ORV) Program will have an adverse affect on organic crop and livestock operations.

We understand the ORV Program to be an emergency disease treatment for the control of rabies. As such the program is addressed under NOP section 205.672, Emergency pest or disease treatment. We further understand that APHIS-WS will typically hand bait in highly populated urban areas and will typically aerially distribute the baits in other areas at the rate of approximately 75 baits per square kilometer.

We have determined that the placement of ORV bait blocks, consisting of a genetically engineered vaccine imbedded in fishmeal bound by a polymer binding agent, on an organic operation will not have an adverse impact on that organic operation. This determination is applicable to ground and aerial distribution of ORV baits. The basis of this determination is that the vaccine is not expected to contact organic crops or to be consumed by organic livestock.

In the unlikely event that a bait block breaks and exposes a plant(s) to the vaccine, the organic producer can remove the affected plant(s) with no adverse effect on the operation's certification. This would comply with section 205.672(a). The organic status of animals feeding on the ORV bait block and not penetrating the vaccine will not be adversely affected. In the unlikely event that an animal consumes the vaccine within the ORV bait block that animal will lose organic status as provided in NOP section 205.672(b).

After reviewing documents provided by APHIS-WS, we believe there is little chance that an organic animal will consume the vaccine within an ORV bait block regardless of whether the baits are hand or aerially distributed. To further reduce the chances of livestock consumption, baits

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distributed by hand should be placed outside of areas containing livestock. When baits are aerially distributed livestock producers can reduce the chances of livestock consumption by relocating any bait found within an area containing livestock to a point outside of that area.

Thank you for your interest in the NOP. If we can be of further assistance we can be reached at 202-720-3252.

Sincerely,

Richard H. Mathews
Program Manager
National Organic Program

APPENDIX H
NATIONAL FOREST SYSTEM (NFS) LANDS AND ACREAGE[1] WITHIN CURRENT OR POTENTIAL ORV ZONES AND MAPS OF FORESTS

- **FOREST SERVICE REGION 8 – SOUTHERN REGION**
  - **AL**
    Talladega National Forest (389,831 NFS acres)
    Tuskegee National Forest (11,252 NFS acres)
    Conecuh National Forest (83,858 NFS acres)
    William B. Bankhead National Forest (181,033 NFS acres)
  - **FL**
    Ocala National Forest (383,584 NFS acres)
    Apalachicola National Forest (565,585 NFS acres)
    Osceola National Forest (162,157 NFS acres)
  - **GA**
    Chattahoochee National Forest (748,372 NFS acres)
    Ed Jenkins National Recreation Area (23,166 NFS acres)
    Oconee National Forest (115,225 NFS acres)
  - **KY**
    Daniel Boone National Forest (557,789 NFS acres)
    Land Between the Lakes National Recreation Area (170,310 NFS acres)
    Jefferson National Forest (720,552 NFS acres)
  - **LA**
    Kisatchie National Forest (603,393 NFS acres)
  - **MS**
    Bienville National Forest (178,542 NFS acres)
    Delta National Forest (60,215 NFS acres)
    DeSoto National Forest (517,939 NFS acres)
    Holly Springs National Forest (155,661 NFS acres)
    Homochitto National Forest (191,585 NFS acres)
    Tombigee National Forest (66,874 NFS acres)
  - **NC**
    Pisgah National Forest (506,785 NFS acres)
    Nantahala National Forest (530,202 NFS acres)
    Croatan National Forest (159,885 NFS acres)
    Uwharrie National Forest (50,174 NFS acres)
  - **SC**
    Francis Marion-Sumter National Forests (364,598 NFS acres)
  - **TN**
    Cherokee National Forest (636,125 NFS acres)
    Land Between the Lakes National Recreation Area (170,310 NFS acres)

[1] Although entire National Forest System acreage is listed, only portions of each National Forest may be baited, depending on the needs of the program over time.

- **VA**
  George Washington National Forest (1,065,232 NFS acres)
  Jefferson National Forest (720,552 NFS acres)
  Mount Rogers National Recreation Area (118,509 NFS acres)

- **FOREST SERVICE REGION 9 – EASTERN REGION**

  - **IN**
    Hoosier National Forest (199,291 NFS acres)

  - **ME**
    White Mountain National Forest (746,581 NFS acres)
    White Mountain National Forest Purchase Unit (34,251 NFS acres)

  - **MI**
    Hiawatha National Forest (894,652 NFS acres)
    Huron National Forest (437,269 NFS acres)
    Manistee National Forest (538,979 NFS acres)
    Ottawa National Forest (984,290 NFS acres)

  - **NH**
    White Mountain National Forest (746,581 NFS acres)
    White Mountain National Forest Purchase Unit (34,251 NFS acres)

  - **NY**
    Finger Lakes National Forest (16, 211 NFS acres)

  - **OH**
    Wayne National Forest (232,610 NFS acres)
    Wayne National Forest Purchase Unit (1,027 NFS acres)

  - **PA**
    Allegheny National Forest (513,139 NFS acres)
    Allegheny National Recreation Area (23,063 NFS acres)

  - **VT**
    Green Mountain National Forest (384,196 NFS acres)

  - **WV**
    George Washington National Forest (1,065,232 NFS acres)
    Jefferson National Forest (720,552 NFS acres)
    Monongahela National Forest (897,892 NFS acres)
    Monongahela National Forest Purchase Unit (5,986 NFS acres)
    Spruce Knob-Seneca Rock National Recreation Area (57,237 NFS acres)

WILDERNESS AREAS WOULD BE EXCLUDED FROM ORV PROGRAM

- **WILDERNESS AREAS IN FOREST SERVICE REGION 8 – SOUTHERN REGION**
  - **AL**
    Talladega National Forest
    - Cheaha (7,245 NFS acres)
    - Dugger Mountain (9,200 NFS acres)

    William B. Bankhead National Forest
    - Sipsey (24,922 NFS acres)

- **FL**
  Apalachicola National Forest
  - Bradwell Bay (24,602 NFS acres)
  - Mud Swamp/New River (8,090 NFS acres)

  Ocala National Forest
  - Alexander Springs (7,941 NFS acres)
  - Billies Bay (3,092 NFS acres)
  - Juniper Prairie (14,277 NFS acres)
  - Little Lake George (2,833 NFS acres)

  Osceola National Forest
  - Big Gum Swamp (13,660 NFS acres)

- **GA**
  Chattahoochee National Forest
  - Big Frog (89 NFS acres)
  - Blood Mountain (7,800 NFS acres)
  - Brasstown (12,896 NFS acres)
  - Cohutta (35,268 NFS acres)
  - Ellicott Rock (2,021 NFS acres)
  - Mark Trail (16,400 NFS acres)
  - Raven Cliffs (9,115 NFS acres)
  - Rich Mountain (9,476 NFS acres)
  - Southern Nantahala (11,770 NFS acres)
  - Tray Mountain (9,702 NFS acres)

- **KY**
  - Daniel Boon National Forest
  - Beaver Creak (4,753 NFS acres)
  - Clifty (12,026 NFS acres)

- **LA**
  - Kisatchie National Forest
  - Kisatchie Hills (8,679 NFS acres)

- **MS**
  - DeSoto National Forest
  - Black Creek (5,052 NFS acres)
  - Leaf (994 NFS acres)

- **NC**
  Croatan National Forest
  - Catfish Lake South (8,530 NFS acres)
  - Pocosin (11,709 NFS acres)
  - Pond Pine (1,685 NFS acres)
  - Sheep Ridge (9,297 NFS acres)

  Nantahala National Forest
  - Ellicott Rock (3,394 NFS acres)
  - Joyce Kilmer-Slickrock (13,562 NFS acres)
  - Southern Nantahala (11,703 NFS acres)

  Pisgah National Forest
  - Linville Gorge (11,786 NFS acres)
  - Middle Prong (7,460 NFS acres)
  - Shining Rock (18,483 NFS acres)

  Uwharrie National Forest

- Birkhead Mountains (5,025 NFS acres)

- **SC**
  Francis-Marion National Forest
  - Hell Hole Bay (2,125 NFS acres)
  - Little Wambaw Swamp (5,047 NFS acres)
  - Wambaw Creek (1,825 NFS acres)
  - Wambaw Swamp (4,815 NFS acres)

  Sumter National Forest
  - Ellicott Rock (2,859 NFS acres)

- **TN**
  Cherokee National Forest
  - Bald River Gorge (3,721 NFS acres)
  - Big Frog (7,993 NFS acres)
  - Big Laurel Branch (6,332 NFS acres)
  - Citico Creek (16,226 NFS acres)
  - Cohutta (1,709 NFS acres)
  - Gee Creek (2,493 NFS acres)
  - Joyce Kilmer-Slickrock (3,832 NFS acres)
  - Little Frog Mountain (4,666 NFS acres)
  - Pond Mountain (6,890 NFS acres)
  - Sampson Mountain (7,991 NFS acres)
  - Unaka Mountain (4,496 NFS acres)

- **VA**
  George Washington National Forest
  - Barbours Creek (4 NFS acres)
  - Priest (5,963 NFS acres)
  - Ramseys Draft (6,518 NFS acres)
  - Rich Hole (6,450 NFS acres)
  - Rough Mountain (9,300 NFS acres)
  - Saint Mary's (9,835 NFS acres)
  - Shawvers Run (101 NFS acres)
  - Three Ridges (4,608 NFS acres)

  Jefferson National Forest
  - Barbours Creek (5,378 NFS acres)
  - Beartown (5,609 NFS acres)
  - James River Face (8,886 NFS acres)
  - Kimberling Creek (5,542 NFS acres)
  - Lewis Fork (5,618 NFS acres)
  - Little Dry Run (2,858 NFS acres)
  - Little Wilson Creek (3,613 NFS acres)
  - Mountain Lake (8,314 NFS acres)
  - Peters Mountain (3,328 NFS acres)
  - Shawvers Run (3,366 NFS acres)
  - Thunder Ridge (2,344 NFS acres)

- **WILDERNESS AREAS IN FOREST SERVICE REGION 9 – EASTERN REGION**

  - **IN**
    Hoosier National Forest
    - Charles C. Deam (12,945 NFS acres)

- **ME**
  White Mountain National Forest
  - Caribou-Speckled Mountain (12,000 NFS acres)

- **MI**
  Hiawatha National Forest
  - Big Island Lake (5,856 NFS acres)
  - Delirium (11,870 NFS acres)
  - Horseshoe Bay (3,790 NFS acres)
  - Mackinac (12,230 NFS acres)
  - Rock River Canyon (4,640 NFS acres)
  - Round Island (378 NFS acres)

  Ottawa National Forest
  - McCormick (16,850 NFS acres)
  - Sturgeon River Gorge (14,500 NFS acres)
  - Sylvania (18,327 NFS acres)

  Manistee National Forest
  - Nordhouse Dunes (3,450 NFS acres)

- **NH**
  White Mountain National Forest
  - Great Gulf (5,552 NFS acres)
  - Pemigewasset (45,000 NFS acres)
  - Presidential Range-Dry River (27,380 NFS acres)
  - Sandwich Range (25,000 NFS acres)

- **PA**
  Allegheny National Forest
  - Allegheny Islands (368 NFS acres)
  - Hickory Creek (8,663 NFS acres)

- **VT**
  Green Mountain National Forest
  - Big Branch (6,720 NFS acres)
  - Breadloaf (21,480 NFS acres)
  - Bristol Cliffs (3,738 NFS acres)
  - George D. Aiken (5,060 NFS acres)
  - Lye Brook (15,503 NFS acres)
  - Peru Peak (6,920 NFS acres)

- **WV**
  Monongahela National Forest
  - Cranberry (35,864 NFS acres)
  - Dolly Sods (10,215 NFS acres)
  - Laurel Fork North (6,055 NFS acres)
  - Laurel Fork South (5,997 NFS acres)
  - Otter Creek (20,000 NFS acres)

  Jefferson National Forest
  - Mountain Lake (2,721 NFS acres)

NATIONAL FOREST MAPS

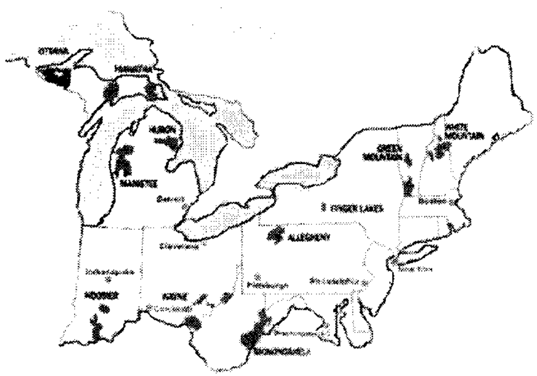
GENERAL

The USFS manages the 191 million acres of the National Forest System in a sustainable manner in collaboration with the American public; interested organizations; private landowners; State, local and tribal governments; federal agencies; and others.

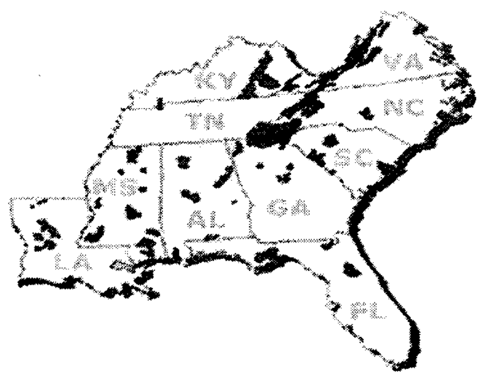
Through the Organic Administration Act of June 4, 1897, (chapter 2, 30 Stat. 34-36) Congress authorized the creation of what is now the National Forest System "to improve and protect" federal forests. To carry out this mission, the USFS has authority "to regulate [the Forests'] occupancy and use and to preserve the forests therein from destruction" (16 U.S.C. 551). The Multiple-Use Sustained-Yield Act of 1960 confirms USFS authority to manage the national forests and grasslands "for outdoor recreation, range, timber, watershed, and wildlife and fish purposes," (16 U.S.C. § 528).

Please see the USFS website, http://www.fs.fed.us/, for detailed descriptions of each National Forest listed in this appendix.

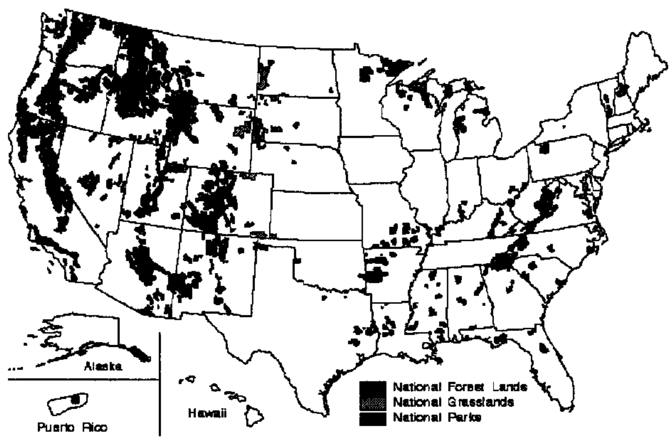
FOREST SERVICE SYSTEM LANDS WITHIN POTENTIAL ORAL RABIES VACCINATION (ORV) ZONES



Portion of USFS Region 9 within ORV Zone



Portion of USFS Region 8 within ORV Zone



Map of U.S. including National Forest System Lands

APPENDIX I
REGIONAL FORESTER SENSITIVE SPECIES, REGIONS 8 AND 9

TABLE 1: REGIONAL FORESTER SENSITIVE SPECIES – REGION 8

National Forest Desigations: 1 = Alabama National Forests, 2 = Daniel Boone National Forest (KY), 3 = Chattahoochee National Forest (GA), 4 = Cherokee National Forest (TN), 5 = Florida National Forests, 6 = Kisatchie National Forest (LA), 7 = Mississippi National Forests, 8 = George Washington/Jefferson National Forests (VA, KY), 11 = North Carolina National Forests, 12 = Sumter National Forest (SC), 17 = Land Between the Lakes National Forest (KY, TN)

National Forest	Group	Scientific Name	Common Name	G-Rank
5	Amphibian	Amphiuma pholeter	One-toed amphiuma	G3
5	Amphibian	Desmognathus apalachicolae	Apalachicola dusky salamander	G3
4	Amphibian	Desmognathus caroliniensis	Carolina Mountain Dusky Salamander	G2
4,11	Amphibian	Desmognathus santeetlah	Santeetlah dusky salamander	G3Q
4,11	Amphibian	Eurycea junaluska	Junaluska salamander	G3Q
10	Amphibian	Eurycea tynerensis	Oklahoma salamander	G3
1	Amphibian	Necturus alabamensis	Black Warrior waterdog	G2
11	Amphibian	Necturus lewisi	Neuse River waterdog	G3
5	Amphibian	Notophthalmus perstriatus	Striped newt	G2G3
4,11	Amphibian	Plethodon aureolus	Tellico salamander	G2G3Q
8	Amphibian	Plethodon hubrichti	Peaks of Otter salamander	G2
6	Amphibian	Plethodon kisatchie	Louisiana slimy salamander	G3Q
8	Amphibian	Plethodon punctatus	Cow Knob salamander	G3
3,4,11	Amphibian	Plethodon teyahalee	Southern Appalachian salamander	G2G3Q
7,12	Amphibian	Plethodon websteri	Webster's salamander	G3
4,8,11	Amphibian	Plethodon welleri	Weller's salamander	G3
1,11,12	Amphibian	Rana capito capito	Carolina gopher frog	G3G4T3
1,2,3,5,6,7,11,12	Bird	Aimophila aestivalis	Bachman's sparrow	G3
1,3,4,8,11	Bird	Falco peregrinus	Peregrine Falcon	G4
5	Bird	Grus canadensis pratensis	Florida sandhill crane	G5T2T3
3,4,8,11,12	Bird	Lanius ludovicianus migrans	Migrant loggerhead shrike	G4T3Q
2,8,11	Bird	Thryomanes bewickii altus	Appalachian Bewick's wren	G5T2Q
11	Crustacean	Caecidotea carolinensis	Bennett's Mill Cave water slater	G1G2
2	Crustacean	Cambarus bouchardi	Big South Fork crayfish	G2G3
3,11,12	Crustacean	Cambarus chaugaensis	Oconee stream crayfish	G2
3	Crustacean	Cambarus cymatilis	A crayfish	G1
1	Crustacean	Cambarus englishi	A crayfish	G3
3	Crustacean	Cambarus extraneus	Chickamauga crayfish	G2
3,11	Crustacean	Cambarus georgiae	Little Tennessee River crayfish	G1
1	Crustacean	Cambarus miltus	Rusty Grave Digger Crayfish	G2
3,11	Crustacean	Cambarus parrishi	Hiwassee Headwaters crayfish	G1
11	Crustacean	Cambarus reburrus	French Broad crayfish	G3
3	Crustacean	Cambarus speciosus	A crayfish	G2
7	Crustacean	Fallicambarus danielae	Speckled burrowing crayfish	G2
7	Crustacean	Fallicambarus gordoni	Camp Shelby burrowing crayfish	G1
6	Crustacean	Faxonella beyeri	Sabine fencing crayfish	G2
6	Crustacean	Faxonella creaseri	Ouachita fencing crayfish	G2
7	Crustacean	Hobbseus attenuatus	A crayfish	G2

6	Crustacean	Orconectes blacki	Calcasieu painted crayfish	G2
6	Crustacean	Orconectes hathawayi	Teche painted crayfish	G3
6	Crustacean	Orconectes maletae	Kisatchie painted crayfish	G2
5	Crustacean	Procambarus attiguus	Silver Glen Springs crayfish	G1
7	Crustacean	Procambarus barbiger	Jackson Prairie crayfish	G2
5	Crustacean	Procambarus delicatus	Big-cheeked cave crayfish	G1
7	Crustacean	Procambarus fitzpatricki	Spiny-tailed crayfish	G2
1	Crustacean	Procambarus marthae	A crayfish	G3
5	Crustacean	Procambarus orcinus	Woodville karst cave crayfish	G1
7	Crustacean	Procambarus penni	Pearl blackwater crayfish	G3
11	Crustacean	Stygobromus carolinensis	Carolina seep scud	G1G2
5,11,12	Fish	Acipenser oxyrhinchus oxyrhinchus	Atlantic sturgeon	G3T3
1,5,7	Fish	Alosa alabamae	Alabama shad	G3
5	Fish	Ameiurus serracanthus	Spotted bullhead	G3
2,6,8	Fish	Ammocrypta clara	Western sand darter	G3
2	Fish	Ammocrypta pellucida	Eastern sand darter	G3
8	Fish	Cottus baileyi	Black sculpin	G2Q
1	Fish	Crystallaria asprella	Crystal darter	G3
6	Fish	Cycleptus elongatus	Blue sucker	G3
3	Fish	Cyprinella callisema	Ocmulgee shiner	G3
3	Fish	Cyprinella callitaenia	Bluestripe shiner	G2
3	Fish	Cyprinella xaenura	Altamaha shiner	G1G2
2	Fish	Etheostoma susanae	Cumberland Johnny darter	G2
4,8,11	Fish	Etheostoma acuticeps	Sharphead darter	G2G3
1	Fish	Etheostoma bellator	Warrior darter	G2
1	Fish	Etheostoma bifascia	Florida sand darter	G3
1,3,4	Fish	Etheostoma brevirostrum	Holiday Darter	G2
2	Fish	Etheostoma cinereum	Ashy darter	G2
11,12	Fish	Etheostoma collis	Carolina darter	G3
1,3	Fish	Etheostoma ditrema	Coldwater darter	G1G2
1	Fish	Etheostoma douglasi	Tuskaloosa Darter	G2
2	Fish	Etheostoma maculatum	Spotted darter	G2
11	Fish	Etheostoma mariae	Pinewoods darter	G3
2	Fish	Etheostoma microlepidum	Smallscale darter	G2G3
8	Fish	Etheostoma osburni	Candy darter	G3
1	Fish	Etheostoma phytophyllum	Rush Darter	G1
7	Fish	Etheostoma raneyi	Yazoo darter	G2
2,8	Fish	Etheostoma tippecanoe	Tippecanoe darter	G3
3	Fish	Etheostoma trisella	Trispot darter	G1
1	Fish	Etheostoma tuscumbia	Tuscumbia darter	G2
3,4,11	Fish	Etheostoma vulneratum	Wounded darter	G3
1	Fish	Etheostoma zonifer	Blackwater darter	G3
7	Fish	Fundulus euryzonus	Broadstripe topminnow	G2
3	Fish	Hybopsis lineapunctata	Lined chub	G3
2,3,4,8	Fish	Ichthyomyzon greeleyi	Mountain brook lamprey	G3
5	Fish	Micropterus notius	Suwannee bass	G2G3
3	Fish	Moxostoma robustum	Robust redhorse	G1
3,8	Fish	Notropis ariommus	Popeye shiner	G3

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6	Fish	Notropis hubbsi	Bluehead shiner	G3
3	Fish	Notropis hypsilepis	Highscale shiner	G3
7	Fish	Notropis melanostomus	Blackmouth shiner	G2
6	Fish	Notropis sabinae	Sabine shiner	G3
8	Fish	Notropis semperasper	Roughhead shiner	G2G3
1	Fish	Notropis uranoscopus	Skygazer shiner	G2
11	Fish	Nopturus furiosus	Carolina Madtom	G3
8	Fish	Noturus gilberti	Orangefin madtom	G2
1,3	Fish	Noturus munitus	Frecklebelly madtom	G3
2	Fish	Noturus stigmosus	Northern madtom	G3
1	Fish	Percina austroperca	Southern logperch	G3
1	Fish	Percina brevicauda	Coal darter	G2
2,4,8,11	Fish	Percina burtoni	Blotchside logperch	G2
1,3	Fish	Percina lenticula	Freckled darter	G2
1,2,4,8,11	Fish	Percina macrocephala	Longhead darter	G3
2,3,4,11	Fish	Percina squamata	Olive darter	G2
3,4,8	Fish	Phenacobius crassilabrum	Fatlips minnow	G3G4
8	Fish	Phenacobius teretulus	Kanawha minnow	G3
4,8	Fish	Phoxinus tennesseensis	Tennessee dace	G2G3
11	Fish	Semotilus lumbee	Sandhills chub	G3
2	Fish	Typhlichthys subterraneus	Southern cavefish	G3
8	Insect	Acroneuria kosztarabi	Kosztarab's common stonefly	G3
7	Insect	Alloperla natchez	Natchez stonefly	G2
5,7,11	Insect	Atrytone arogos arogos	Arogos skipper	G3G4T1T2
11	Insect	Atrytonopsis loammi	Loammi skipper	G2G4Q
3	Insect	Beloneuria georgiana	Georgia beloneurian stonefly	G1G3
8	Insect	Brachypanorpa jeffersoni	Jefferson's short-nosed scorpionfly	G2
8,11	Insect	Callophrys irus	Frosted elfin	G3
8	Insect	Catocala herodias gerhardi	Herodias underwing	G3T3
1	Insect	Cheumatopsyche bibbensis	A caddisfly	G1
1,2,4	Insect	Cheumatopsyche helma	Helma's net-spinning caddisfly	G1G3
8,11	Insect	Cicindela ancocisconensis	A tiger beetle	G3
8	Insect	Cicindela patruela	Barrens tiger beetle	G3
1,5	Insect	Cordulegaster sayi	Say's spiketail	G1G2
8	Insect	Cyclotrachelus incisus	A ground beetle	G2
11	Insect	Dolania americana	Mayfly, American sandburrowing	G3
1	Insect	Epitheca spinosa	Robust baskettail	G3
8	Insect	Erynnis persius persius	Persius duskywing	G4T2T3
8	Insect	Erythroecia herbardi	Hebard's noctuid moth	GU
11	Insect	Euphyes dukesi	Dukes' skipper	G3
3,4	Insect	Gomphus consanguis	Cherokee clubtail	G2G3
11	Insect	Gomphus diminutus	Diminuitive clubtail	G3
1	Insect	Gomphus geminatus	Twin-striped clubtail	G3
1	Insect	Gomphus hodgesi	Hodges' clubtail	G3
11	Insect	Gomphus septima	Septima's clubtail	G2
4,8	Insect	Gomphus viridifrons	Green-faced clubtail	G3
7	Insect	Haploperla chukcho	Chukcho stonefly	G2
11	Insect	Hemipachnobia subporphyrea	Venus flytrap cutworm moth	G1?

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11	Insect	Hesperia attalus slossonae	Dotted skipper	G3G4T3
8	Insect	Hydraena maureenae	Maureen's shale stream beetle	G1G3
1	Insect	Hydroptila cheaha	A caddisfly	G1
1	Insect	Hydroptila choccolocco	A caddisfly	G1
1	Insect	Hydroptila paralatosa	A caddisfly	G2
1	Insect	Hydroptila patriciae	A caddisfly	G1
1	Insect	Hydroptila setigera	A caddisfly	G1
8	Insect	Isoperla major	Beartown perlodid stonefly	G2
6	Insect	Leuctra szczytkoi	Schoolhouse Springs leuctran stonefly	G2
3,4,11	Insect	Macromia margarita	Mountain river cruiser	G2G3
2	Insect	Manophylax butleri	A limnephilid caddisfly	G2
4,8	Insect	Megaleuctra williamsae	William's giant stonefly	G2
11	Insect	Melanoplus attenuatus	Slender-Bodies Malanoplus	G2G3
11	Insect	Melanoplus divergens	Divergent Melanoplus	G2G3
11	Insect	Melanoplus nubilus	A Short-Winged Melanoplus	G3?
11	Insect	Melanoplus serrulatus	Serrulate Melanoplus	G1G3
1	Insect	Oecetis morsei	A caddisfly	G2
1,4,8	Insect	Ophiogomphus alleghaniensis	Allegheny Snaketail	G3Q
3,4,11	Insect	Ophiogomphus edmundo	Edmund's snaketail	G1
2,11	Insect	Ophiogomphus howei	Pygmy snaketail	G3
3,4,11	Insect	Ophiogomphus incurvatus	Appalachian snaketail	G3
1	Insect	Polycentropus carlsoni	Carlson's polycentropus caddisfly	G1G3
1,5	Insect	Progomphus bellei	Belle's sanddragon	G3
11	Insect	Ptichodis bistrigata	Southern ptichodis	G3
2,8	Insect	Pyrgus wyandot	Appalachian grizzled skipper	G2
1	Insect	Rhyacophila carolae	A caddisfly	G1
11	Insect	Scudderia septentrionalis	Northern Bush Katydid	G3?
11	Insect	Semiothisa fraserata	Fraser Fir Angle	G2?
5	Insect	Somatochlora calverti	Calvert's emerald dragonfly	G3
11	Insect	Spartiniphaga carterae	Carter's noctuid moth	G2G3
1,2,3,4,8,11,12	Insect	Speyeria diana	Diana fritillary	G3
2,8,11	Insect	Speyeria idalia	Regal fritillary	G3
1	Insect	Stylurus townesi	Townes' clubtail	G3
8	Insect	Taeniopteryx nelsoni	Nelson's early black stonefly	G2
11	Insect	Trechus carolinae	A ground beetle	G1?
11	Insect	Trechus luculentus unicoi	A ground beetle	G2T2?
11	Insect	Trechus mitchellensis	A ground beetle	G1?
11	Insect	Trechus rosenbergi	A ground beetle	G1?
11	Insect	Trechus satanicus	A ground beetle	G1?
11	Insect	Trimerotropis saxatilis	Rock-loving grasshopper	G3?
1,2,3,4,5,7,11,12,17	Mammal	Corynorhinus rafinesquii	Rafinesque's big-eared bat	G3G4
4,8,11	Mammal	Microtus chrotorrhinus carolinensis	Southern rock vole	G4T3
1,2,12,17	Mammal	Myotis austroriparius	Southeastern myotis	G3G4
2,3,4,8,11,12	Mammal	Myotis leibii	Eastern small-footed bat	G3
5	Mammal	Neofiber alleni	Round-tailed muskrat	G3
5	Mammal	Podomys floridanus	Florida mouse	G3
5	Mammal	Sciurus niger shermani	Sherman's fox squirrel	G5T2
2	Mammal	Sorex dispar blitchi	Long-tailed shrew	G4T3?

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3,4,8,11	Mammal	Sorex palustris puntculatus	Southern water shrew	G5T3
1,5	Mammal	Ursus americanus floridanus	Florida black bear	G5T2
3,8,11,12	Mollusk	Alasmidonta varicosa	Brook floater	G3
5	Mollusk	Alasmidonta wrightiana	Ochlockonee arcmussel	GH
5	Mollusk	Anodonta heardi	Apalachicola floater	G1
2	Mollusk	Anodontoides denigratus	Cumberland papershell	G1
1,7	Mollusk	Anodontoides radiatus	Rayed creekshell	G3
5	Mollusk	Aphaostracon pycnus	Dense hydrobe	G1
5	Mollusk	Cincinnatia vanhyningi	Seminole Spring siltsnail	G1
2,8	Mollusk	Cumberlandia monodonta	Spectaclecase	G2G3
1	Mollusk	Elliptio arca	Alabama spike	G3
8	Mollusk	Elliptio lanceolata	Yellow lance	G2G3
11	Mollusk	Elliptio roanokensis	Roanoke slabshell	G2
2,8	Mollusk	Epioblasma triquetra	Snuffbox	G3
13	Mollusk	Fusconaia askewi	Texas pigtoe	G2
4,8,11	Mollusk	Fusconaia barnesiana	Tennessee pigtoe	G2G3
13	Mollusk	Fusconaia lananensis	Triangle pigtoe	G1Q
8,11	Mollusk	Fusconaia masoni	Atlantic pigtoe	G2
2	Mollusk	Fusconaia subrotunda subrotunda	Long-solid	G3T3
1	Mollusk	Fusconaia succissa	Purple pigtoe	G3
8	Mollusk	Glyphyalinia raderi	Maryland glyph	G2
8	Mollusk	Helicodiscus diadema	Shaggy coil	G1
8	Mollusk	Helicodiscus lirellus	Rubble coil	G1
8,11	Mollusk	Helicodiscus triodus	Tallus coil	G2
8	Mollusk	Io fluvialis	Spiny riversnail	G2
1	Mollusk	Lampsilis australis	Southern sandshell	G2
6	Mollusk	Lampsilis satura	sandbank pocketbook	G3
12	Mollusk	Lampsilis splendida	Rayed Pink Fatmucket	G3
1	Mollusk	Lasmigona complanta alabamensis	Alabama heelsplitter	G5T2T3
1,3,4,8,11	Mollusk	Lasmigona holstonia	Tennessee Heelsplitter	G3
4,8,11	Mollusk	Lasmigona subviridis	Green floater	G3
4,8	Mollusk	Lexingtonia dolabelloides	Slabside pearlymussel	G2
1	Mollusk	Margaritifera marrianae	Alabama pearlshell	G1
1,6	Mollusk	Obovaria jacksoniana	Southern hickorynut	G1G2
1	Mollusk	Obovaria unicolor	Alabama hickorynut	G3
11	Mollusk	Pallifera hemphilli	Black mantleslug	G3
4,11	Mollusk	Paravitrea placentula	Glossy supercoil	G3
8	Mollusk	Paravitrea reesi	Round supercoil	G3
2,8	Mollusk	Plethobasus cyphyus	Sheepnose	G3
7	Mollusk	Pleurobema beadleianum	Mississippi pigtoe	G2G3
8	Mollusk	Pleurobema cordatum	Ohio pigtoe	G3
3,4	Mollusk	Pleurobema hanleyianum	Georgia pigtoe	G1
2,4,8	Mollusk	Pleurobema oviforme	Tennessee clubshell	G3
6	Mollusk	Pleurobema riddellii	Louisiana pigtoe	G1G2
2,7,8	Mollusk	Pleurobema rubrum	Pyramid pigtoe	G2
2	Mollusk	Pleurocera curta	Shortspire hornsnail	G2
6	Mollusk	Potamilus amphiachaenus	Texas heelsplitter	G1
1	Mollusk	Ptychobranchus jonesi	Southern kidneyshell	G1

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3	Mollusk	Pyganodon gibbosa	Inflated floater	G3Q
2	Mollusk	Quadrula cylindrica cylindrica	Rabbitsfoot	G3T3
1,3	Mollusk	Quadrula rumphiana	Ridged mapleleaf	G3
2	Mollusk	Rhodacme elatior	Domed ancylic	G1G3
2	Mollusk	Simpsonaias ambigua	Salamander mussel	G3
1,3,4	Mollusk	Strophitus connasaugaensis	Alabama creekmussel	G3
1,6	Mollusk	Strophitus subvexus	Southern creekmussel	G2
2,8	Mollusk	Toxolasma lividus	Purple lilliput	G2
11	Mollusk	Toxolasma pullus	Savannah lilliput	G3
5	Mollusk	Utterbackia peggyae	Florida floater	G3
11	Mollusk	Ventridens coelaxis	Bidentate dome	G3
2	Mollusk	Vertigo bollesiana	Delicate vertigo	G3
2	Mollusk	Vertigo clappi	Cupped vertigo	G2
1	Mollusk	Villosa choctawensis	Choctaw bean	G2
1,3,4	Mollusk	Villosa nebulosa	Alabama rainbow	G3
1,4	Mollusk	Villosa vanuxemensis umbrans	Coosa combshell	G4T2
11	Mollusk	Villosa vaughaniana	Carolina creekshell	G2
8	Other Invert.	Arrhopalites carolynae	A cave springtail	G2G3
8	Other Invert.	Arrhopalites commorus	A cave springtail	G1G2
8	Other Invert.	Arrhopalites sacer	A cave springtail	G1G2
8	Other Invert.	Brachoria dentata	A millipede	G1
8	Other Invert.	Brachoria ethotela	Hungry mother millipede	G2
8	Other Invert.	Buotus carolinus	A millipede	G1
8	Other Invert.	Caecidotea incurva	Incurved cave isopod	G2G3
8	Other Invert.	Cleidogona hoffmani	Hoffman's cleidogonid millipede	G2
8	Other Invert.	Cleidogona lachesis	A millepede	G2
5	Other Invert.	Crangonyx hobbsi	Hobbs' cave amphipod	G2G3
8	Other Invert.	Dixioria coronata	A millipede	G2
8	Other Invert.	Dixioria fowleri	A millepede	G2
8	Other Invert.	Escaryus cryptorobius	Montane centipede	G2
8	Other Invert.	Escaryus orestes	Whitetop Mountain centipede	G1G2
8	Other Invert.	Euchlaena milnei	Milne's Euchlaena	G2
11	Other Invert.	Hypochilus coylei	A cave spider	G3?
11	Other Invert.	Hypochilus sheari	A lampshade spider	G2G3
8	Other Invert.	Kleptochthonius orpheus	Orpheus cave pseudoscorpion	G1
8	Other Invert.	Miktoniscus racovitzae	Racovitza's terrestrial cave isopod	G2
8	Other Invert.	Nampabius turbator	A cave centipede	G1G2
8	Other Invert.	Nannaria shenandoah	Shenandoah Mountain xystodesmid	G1
11	Other Invert.	Nesticus crosbyi	a cave spider	G1?
11	Other Invert.	Nesticus cooperi	Lost Nantahala Cave spider	G1?
11	Other Invert.	Nesticus mimus	Cave spider	G2
11	Other Invert.	Nesticus sheari	Cave spider	G2?
11	Other Invert.	Nesticus silvanus	Cave spider	G2?
5	Other Invert.	Progomphus bellei	Belle's sand clubtail	G3
8	Other Invert.	Pseudotremia alecto	A millipede	G1
8	Other Invert.	Semionellus placidus	A millipede	G3
8	Other Invert.	Stygobromus abditus	James Cave amphipod	G1
8	Other Invert.	Stygobromus cumberlandus	Cumberland Cave amphipod	G2G3

8	Other Invert.	Stygobromus estesi	Craig County cave amphipod	G1
8	Other Invert.	Stygobromus fergusoni	Montgomery County cave amphipod	G1G2
8	Other Invert.	Stygobromus gracilipes	Shenandoah Valley cave amphipod	G2
8	Other Invert.	Stygobromus hoffmani	Alleghany County cave amphipod	G1
8	Other Invert.	Stygobromus mundus	Bath County cave amphipod	G1G2
3,4	Reptile	Clemmys muhlenbergi	Bog turtle	G3
1,5	Reptile	Gopherus polyphemus	Gopher tortoise	G3
1	Reptile	Graptemys ernsti	Escambia map turtle	G2
5	Reptile	Lampropeltis getula goini	Apalachicola kingsnake	G5T2
11	Reptile	Nerodia sipedon williamengelsi	Carolina salt marsh snake	G5T3
1,11	Reptile	Ophisaurus mimicus	Mimic glass lizard	G3
7	Reptile	Pithuophis melanoleucus lodingi	Black pine snake	G4T3
1,5	Reptile	Pituophis melanoleucus mugitus	Florida pine snake	G5T3?
6	Reptile	Pituophis melanoleucus ruthveni	Louisiana pinesnake	G4T3
5	Reptile	Pseudemys concinna suwanniensis	Suwannee cooter	G5T3
5	Reptile	Sceloporus woodi	Florida scrub lizard	G3
5	Reptile	Stilosoma extenuatum	Short-tailed snake	G3
4,11	Nonvasc. Plant	Acrobolbus ciliatus	A liverwort	G3?
1,11	Nonvasc. Plant	Aneura maxima (= A. sharpii)	A liverwort	G1G2
11	Nonvasc. Plant	Anzia americana	A Foliose Lichen	G2
11	Nonvasc. Plant	Aspiromitus appalachianus	A Hornwort	G1
11	Nonvasc. Plant	Bartramidula wilsonii	Dwarf apple moss	G3?
4,11	Nonvasc. Plant	Bazzania nudicaulis	Bazzania moss	G2G3
11	Nonvasc. Plant	Brachydontium trichodes	Peak moss	G2
11	Nonvasc. Plant	Bryocrumia vivicolor	Gorge moss	G2
4,11	Nonvasc. Plant	Buxbaumia minakatae	Hump-backed Elves	G2G3
11	Nonvasc. Plant	Campylopus carolinae	Carolina campylopus	G1
11	Nonvasc. Plant	Campylopus paradoxus	Paradoxical campylopus	G3?
11	Nonvasc. Plant	Cephalozia macrostachya ssp australis	A liverwort	G4T1
4,11	Nonvasc. Plant	Cephaloziella massalongi	A liverwort	G2G3
1,11	Nonvasc. Plant	Cheilolejeunea evansii	A liverwort	G1
11	Nonvasc. Plant	Cylindrocolea rhizantha	A Liverwort	G3?
11	Nonvasc. Plant	Diplophyllum apiculatum var. taxifolioides	A Liverwort	G5T1Q
11	Nonvasc. Plant	Diplophyllum obtusatum	A Liverwort	G2?
11	Nonvasc. Plant	Ditrichum ambiguum	Ambiguous ditrichum	G3?
3,4,11	Nonvasc. Plant	Drepanolejeunea appalachiana	A liverwort	G2?
4,11	Nonvasc. Plant	Entodon concinnus	Lime entodon	G4G5
11	Nonvasc. Plant	Ephebe americana	A Fructicose Lichen	G2G3
11	Nonvasc. Plant	Fissidens appalachiensis	Appalachian Pocket Moss	G2G3
11	Nonvasc. Plant	Fissidens hallii	Hall's fissiden moss	G2
11	Nonvasc. Plant	Frullania appalachiana	A Liverwort	G1?
11	Nonvasc. Plant	Frullania donnellii	A liverwort	G3?
11	Nonvasc. Plant	Frullania oakesiana	A liverwort	G3?
11	Nonvasc. Plant	Homaliadelphus sharpii	Sharp's homaliadelphus	G3
4,11	Nonvasc. Plant	Hydrothyria venosa	An aquatic lichen	G3
2,11	Nonvasc. Plant	Hygrohypnum closteri	Closter's brook-hypnum	G3
11	Nonvasc. Plant	Hypotrachyna virginica	A Foliose Lichen	G1G3
4,11	Nonvasc. Plant	Lejeunea blomquistii	A liverwort	G1G2

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11	Nonvasc. Plant	Lejeunea dimorphophylla	A liverwort	G2G3
4,11	Nonvasc. Plant	Leptodontium excelsum	Grandfather Mountain leptodontium	G2
11	Nonvasc. Plant	Leptohymenium sharpii	Mount Leconte moss	G1
4,11	Nonvasc. Plant	Lophocolea appalachiana	A liverwort	G1G2?
11	Nonvasc. Plant	Mannia californica	A Liverwort	G3?
11	Nonvasc. Plant	Marsupella emarginata var. latiloba	A Liverwort	G5T1T2
4,11	Nonvasc. Plant	Megaceros aenigmaticus	A hornwort	G2G3
4,11	Nonvasc. Plant	Metzgeria fruticulosa (= M. temperata)	A Liverwort	G2Q
11	Nonvasc. Plant	Metzgeria furcata var. setigera	A Liverwort	G4T1
4,11	Nonvasc. Plant	Metzgeria uncigera	A liverwort	G3
4,11	Nonvasc. Plant	Nardia lescurii	A liverwort	G3?
1,3,4,11	Nonvasc. Plant	Pellia X appalachiana	A liverwort	G1?
11	Nonvasc. Plant	Physcia pseudospeciosa	Rosette lichen	G1?
11	Nonvasc. Plant	Plagiochasma intermedium	A Liverwort	G3?
11	Nonvasc. Plant	Plagiochasma wrightii	A Liverwort	G3?
2,11	Nonvasc. Plant	Plagiochila austinii	A liverwort	G3
3,4,11	Nonvasc. Plant	Plagiochila caduciloba	A liverwort	G2
1,3,4,11	Nonvasc. Plant	Plagiochila echinata	A liverwort	G2
3,11	Nonvasc. Plant	Plagiochila sharpii	Sharp's leafy liverwort	G2G3
11	Nonvasc. Plant	Plagiochila sullivantii var spinigera	A liverwort	G2T1
2,11	Nonvasc. Plant	Plagiochila sullivantii var sullivantii	Sullivant's leafy liverwort	G2T2
11	Nonvasc. Plant	Plagiochila virginica var caroliniana	A liverwort	G3T2
11	Nonvasc. Plant	Plagiochila virginica var virginica	A liverwort	G3T3
3,11	Nonvasc. Plant	Plagiomnium carolinianum	Carolina plagiomnium	G3
3,11	Nonvasc. Plant	Platyhypnidium pringlei	Pringle's platyhypnidium	G2
4,11	Nonvasc. Plant	Polytrichum appalachianum	Appalachian haircap moss	G3
11	Nonvasc. Plant	Porella japonica ssp appalachiana	Appalachian porella	G5?T1
4,11	Nonvasc. Plant	Porella wataugensis	Watauga porella	G2
11	Nonvasc. Plant	Porpidia diversa	A crustose Lichen	G2G3
11	Nonvasc. Plant	Porpidia herteliana	A crustose Lichen	G2G3
1,2,3,11	Nonvasc. Plant	Radula sullivantii	A liverwort	G2
11	Nonvasc. Plant	Radula voluta	A liverwort	G3
11	Nonvasc. Plant	Rhachithecium perpusillum	Rhachithecium moss	G3?
1,4,11	Nonvasc. Plant	Riccardia jugata	A liverwort	G1G2
11	Nonvasc. Plant	Schlotheimia lancifolia	Highlands moss	G2
2,11	Nonvasc. Plant	Scopelophila cataractae	Agoyan cataract moss	G3
11	Nonvasc. Plant	Sphagnum fitzgeraldii	Fitzgerald's peatmoss	G2G3
11	Nonvasc. Plant	Sphagnum flavicomans	A peatmoss	G3?
11	Nonvasc. Plant	Sphagnum macrophyllum var. floridanum	Florida Peatmoss	G3T3
11	Nonvasc. Plant	Sphenolobopsis pearsonii	A liverwort	G2
11	Nonvasc. Plant	Splachnum pennsylvanicum	Pennsylvania dung moss	G2?
4,11	Nonvasc. Plant	Sticta limbata	A Foliose Lichen	G3G4
11	Nonvasc. Plant	Taxiphyllum alternans	Japanese yew-moss	G3?
11	Nonvasc. Plant	Teloschistes flavicans	Sunrise Lichen	G3G4
1	Nonvasc. Plant	Tetrodontium brownianum	Little Georgia moss	G3
4,11	Nonvasc. Plant	Tortula ammonsiana	Ammons' tortula	G2?
7	Nonvasc. Plant	Trachyxiphium heteroicum	Trachyxiphium moss	G2G3
11	Nonvasc. Plant	Xanthoparmelia monticola	Xanthoparmelia lichen	G2

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4,11	Vascular Plant	Aconitum reclinatum	Trailing white monkshood	G3
1	Vascular Plant	Aesculus parviflora	Small-flowered buckeye	G2G3
1,5	Vascular Plant	Agalinis divaricata	Pinelands false foxglove	G3
7	Vascular Plant	Agalinis pseudaphylla	Shinner's false foxglove	G2?Q
1,3,5,6,7,11,12	Vascular Plant	Agrimonia incisa	Incised agrimony	G3
11	Vascular Plant	Allium cuthbertii	Striped garlic	G3
8	Vascular Plant	Allium oxyphilum	Nodding onion	G2G3Q
3,11,12	Vascular Plant	Amorpha schwerinii	Schwerin's false indigo	G3
6	Vascular Plant	Amsonia ludoviciana	Louisiana bluestar	G3
1,5	Vascular Plant	Andropogon arctatus	Pinewoods bluestem	G3
5	Vascular Plant	Angelica dentata	Coastalplain angelica	G2G3
1,3	Vascular Plant	Arabis georgiana	Georgia rockcress	G2
8,11	Vascular Plant	Arabis patens	Spreading rockcress	G3
5	Vascular Plant	Aristida mohrii	Mohr's threeawn	G1
5	Vascular Plant	Aristida patula	Tall threeawn	G3
5	Vascular Plant	Aristida rhizomophora	Florida threeawn grass	G2
5,7	Vascular Plant	Aristida simpliciflora	Southern three-awn grass	G2
5	Vascular Plant	Arnoglossum diversifolium	Variableleaf Indian plantain	G2
5	Vascular Plant	Arnoglossum floridanum	Florida cacalia	G3
1,5	Vascular Plant	Arnoglossum sulcatum	Indian plantain	G2G3
5	Vascular Plant	Asclepias curtissii	Curtiss' milkweed	G3
5	Vascular Plant	Asclepias viridula	Southern milkweed	G2
1,11	Vascular Plant	Asplenium X ebenoides	Scott's spleenwort	HYB
11,12	Vascular Plant	Asplenium X heteroresiliens	Carolina spleenwort	HYB
11	Vascular Plant	Aster avitus	Alexander's rock aster	G3
5	Vascular Plant	Aster chapmanii	Savannah aster	G2G3
1,5	Vascular Plant	Aster eryngiifolius	Thistleleaf aster	G3G4
3,4,11,12	Vascular Plant	Aster georgianus	Georgia aster	G2G3
11	Vascular Plant	Aster mirabilis	Bouquet aster	G2G3
2	Vascular Plant	Aster saxicastellii	Rockcastle aster	G1G2
1,11	Vascular Plant	Astragalus michauxii	Sandhills milkvetch	G3
1	Vascular Plant	Astragalus tennesseensis	Tennessee milkvetch	G3
1,2,3,17	Vascular Plant	Aureolaria patula	Spreading yellow false foxglove	G2G3
1	Vascular Plant	Baptisia megacarpa	Appalachian wild indigo	G2
5	Vascular Plant	Baptisia simplicifolia	Scareweed	G3
2,3,4,11	Vascular Plant	Berberis canadensis	American barberry	G3
5	Vascular Plant	Berlandiera subacaulis	Florida greeneyes	G3
5	Vascular Plant	Boltonia apalachicolensis	Apalachicola doll's daisy	G2Q
4,11	Vascular Plant	Botrychium jenmanii	Dixie grapefern	G3G4
4,8,11	Vascular Plant	Buckleya distichophylla	Piratebush	G2
4,11	Vascular Plant	Calamagrostis cainii	Cain's reed grass	G1
5	Vascular Plant	Calamintha ashei	Ashe's calamint	G3
5	Vascular Plant	Calamintha dentata	Florida calamint	G3
1,7,11,12	Vascular Plant	Calopogon multiflorus	Many-flower grass pink	G2G3
3,4,8,11	Vascular Plant	Cardamine clematitis	Small mountain bittercress	G2G3
11	Vascular Plant	Cardamine longii	Long's bittercress	G3Q
5,7	Vascular Plant	Carex baltzelli	Baltzell's sedge	G3
3,11	Vascular Plant	Carex biltmoreana	Stiff sedge	G3

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1	Vascular Plant	Carex brysonii	Bryson's sedge	G1
3,11,12	Vascular Plant	Carex communis var. amplisquama	Fort Mountain sedge	G3
1,5,6,7,12	Vascular Plant	Carex decomposita	Cypress-knee sedge	G3
1,7,11	Vascular Plant	Carex impressinervia	Ravine sedge	G1G2
2	Vascular Plant	Carex juniperorum	Juniper sedge	G2
3,4,11	Vascular Plant	Carex misera	Wretched sedge	G3
8	Vascular Plant	Carex polymorpha	Variable sedge	G3
3,11	Vascular Plant	Carex radfordii	Radford's sedge	G2
3,4,11	Vascular Plant	Carex roanensis	Roan sedge	G1
8,11	Vascular Plant	Carex schweinitzii	Schweinitz's sedge	G3
7	Vascular Plant	Castanea pumila var. ozarkensis	Ozark chinquapin	G5T3
1	Vascular Plant	Castilleja sp. nov. "kraliana"	Kral's Indian paintbrush	G2
5	Vascular Plant	Centrosema arenicola	Pineland butterfly pea	G2
3,8,11	Vascular Plant	Chelone cuthbertii	Cuthbert's turtlehead	G3
4,8,17	Vascular Plant	Cimicifuga rubifolia	Appalachian bugbane	G3
2,5,8,11	Vascular Plant	Cleistes bifaria	Small spreading pogonia	G3G4
8	Vascular Plant	Clematis addisonii	Addison's leatherflower	G2
8	Vascular Plant	Clematis coactilis	Virginia white-haired leatherflower	G2G3
1,5	Vascular Plant	Coelorachis tuberculosa	Bumpy joittail grass	G3
2,4,12	Vascular Plant	Collinsonia verticillata	Stoneroot	G3
8	Vascular Plant	Corallorhiza bentlyi	Bently's corralroot	G1
3,4,11	Vascular Plant	Coreopsis latifolia	Broadleaf tickseed	G3
5	Vascular Plant	Coreopsis nudata	Georgia tickseed	G3?
11	Vascular Plant	Coreopsis X delphiniifolia	Larkspur Coreopsis	HYB
7	Vascular Plant	Crataegus harbisonii (=C. ashei)	Ashe hawthorne	G1
7	Vascular Plant	Crataegus triflora	Three-flower hawthorne	G2
1	Vascular Plant	Croton alabamensis	Alabama croton	G3
5	Vascular Plant	Ctenium floridanum	Florida toothache grass	G2
6	Vascular Plant	Cyperus grayioides	Mohlenbrock's Umbrella-sedge	G3
1,2,6,17	Vascular Plant	Cypripedium kentuckiense	Northern Lady's slipper	G3
4,11	Vascular Plant	Danthonia epilis	Bog oat-grass	G3?
1	Vascular Plant	Delphinium alabamicum	Alabama larkspur	G2
4,8,11	Vascular Plant	Delphinium exaltatum	Tall larkspur	G3
11	Vascular Plant	Desmodium ochroleucum	Cream tick-trefoil	G2G3
11	Vascular Plant	Dichanthelium hirstii	Hirsts' panic grass	G1
1,4,11	Vascular Plant	Diervilla rivularis	Riverbank bush-honeysuckle	G3
11	Vascular Plant	Dioneae muscipula	Venus flytrap	G3
2	Vascular Plant	Dodecatheon frenchii	French's shooting star	G3
11	Vascular Plant	Ericaulon parkeri	Parker's pipewort	G3
5	Vascular Plant	Euphorbia discoidalis	Summer spurge	G3?Q
8,11	Vascular Plant	Euphorbia purpurea	Glade Spurge	G3
5	Vascular Plant	Forestiera godfreyi	Godfrey's swampprivet	G3
1,3,4,11,12	Vascular Plant	Fothergilla major	Large witchalder	G3
5	Vascular Plant	Galactia microphylla	Littleleaf milkpea	G3?
4,11	Vascular Plant	Gentiana austromontana	Appalachian gentian	G3
5	Vascular Plant	Gentiana pennelliana	Wiregrass gentian	G3
4,11	Vascular Plant	Geum geniculatum	Bent avens	G2
4,11	Vascular Plant	Glyceria nubigena	Great Smoky Mountain mannagrass	G2

11	Vascular Plant	Grammitis nimbata	West Indian polypody	G4?
5	Vascular Plant	Hartwrightia floridana	Florida hartwrightia	G2
5	Vascular Plant	Hasteola robertiorum	Hammockherb	G1
8,11,17	Vascular Plant	Hasteola suaveolens	False Indian-plantain	G3
4,11	Vascular Plant	Helianthus glaucophyllus	Whiteleaf sunflower	G3
1	Vascular Plant	Helianthus longifolius	Longleaf sunflower	G3
1,3	Vascular Plant	Helianthus smithii	Smith sunflower	G2Q
8	Vascular Plant	Heuchera alba	White alumroot	G2Q
11	Vascular Plant	Heuchera caroliniana	Carolina Alumroot	G3
4,11	Vascular Plant	Heuchera longiflora var. aceroides	maple-leaf alumroot	G4T2Q
2,8,11	Vascular Plant	Hexastylis contracta	Mountain heartleaf	G3
11	Vascular Plant	Hexastylis rhombiformis	North Fork heartleaf	G2
1,3	Vascular Plant	Hexastylis shuttlesworthii var. harperi	Harper's wild ginger	G4T3
1	Vascular Plant	Hexastylis speciosa	Harper's heartleaf	G2
1,12	Vascular Plant	Hymenocallis caroliniana (=H. coronaria)	Carolina spider lily	G2Q
5	Vascular Plant	Hymenocallis henryae	Henry's spiderlily	G2
1,3,11	Vascular Plant	Hymenophyllum tayloriae	Taylor's filmy fern	G1G2
5	Vascular Plant	Hypericum chapmanii	Apalachicola St. Johnswort	G3
5	Vascular Plant	Hypericum exile	Florida sands St. Johnswort	G2G3
4,11	Vascular Plant	Hypericum graveolens	Mountain St. Johnswort	G3
4,8.11	Vascular Plant	Hypericum mitchellianum	Blue Ridge St. Johnswort	G3
4,8,11	Vascular Plant	Ilex collina	Longstalked holly	G3
8	Vascular Plant	Iliamna remota	Kankakee globe-mallow	G1Q
5	Vascular Plant	Illicium parviflorum	Yellow anisetree	G2
11	Vascular Plant	Isoetes microvela	Quillwort	G1
8,11	Vascular Plant	Isoetes virginica	Virginia quillwort	G1
1	Vascular Plant	Jamesianthus alabamensis	Alabama jamesianthus	G3
1,2,4,11,12,17	Vascular Plant	Juglans cinerea	Butternut	G3G4
11	Vascular Plant	Juncus caesariensis	New Jersey Rush	G2
5	Vascular Plant	Justicia crassifolia	Thickleaf waterwillow	G2
11	Vascular Plant	Kalmia cuneata	White Wicky	G3
5,11	Vascular Plant	Lachnocaulon beyrichianum	Southern bogbutton	G2G3
1,5,6,7	Vascular Plant	Lachnocaulon digynum	Pineland bogbutton	G3
5	Vascular Plant	Lachnocaulon engleri	Engler's bogbutton	G3
1	Vascular Plant	Leavenworthia alabamica var. alabamica	Alabama gladecress	G2G3T2T3Q
1	Vascular Plant	Leavenworthia crassa	Golden gladecress	G2
5	Vascular Plant	Lechea cernua	Texas Golden Bladecress	G1
5	Vascular Plant	Lechea divaricata	Nodding pinweed	G3
1	Vascular Plant	Lesquerella densipila	Threadleaf bladderpod	G3
2	Vascular Plant	Lesquerella globosa	Duck River bladderpod	G3
6	Vascular Plant	Liatris tenuis	Branched gay feather	G2
11	Vascular Plant	Liatris turgida	Slender gay feather	G3
4,8,11	Vascular Plant	Lilium grayi	Shale-barren blazing star	G3
1	Vascular Plant	Lilium iridollae	Gray's lily	G3
1,7,11	Vascular Plant	Lindera subcoriacea	Panhandle lily	G1G2
1,7	Vascular Plant	Linum macrocarpum	Smallstalk necklace fern	G1
5	Vascular Plant	Linum westii	Spring Hill flax	G2?
5,11,12	Vascular Plant	Litsea aestivalis	West's flax	G2

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11,12	Vascular Plant	Lobelia boykinii	Pondspice	G3
11	Vascular Plant	Lotus helleri	Boykin's lobelia	G2G3
11	Vascular Plant	Ludwigia ravenii	Heller's bird-foot trefoil	G3
5	Vascular Plant	Lupinus westianus	Raven's Seedbox	G2?
8	Vascular Plant	Lycopodiella margueritae	Gulf coast lupine	G2
1,3,4,11,12,17	Vascular Plant	Lysimachia fraseri	Marguerite's clubmoss	G2
12	Vascular Plant	Lysimachia loomisii	Fraser's yellow loosestrife	G2
5	Vascular Plant	Lythrum curtissii	Loomis yellow loosestrife	G3
11	Vascular Plant	Macbridea caroliniana	Curtiss' loosestrife	G1
1,5,7	Vascular Plant	Macranthera flammea	Carolina birds-in-a-nest	G2G3
5	Vascular Plant	Magnolia ashei	Flame flower	G3
11	Vascular Plant	Malaxis bayardii	Ashe's magnolia	G2
2,11	Vascular Plant	Marshallia grandiflora	Jungle netvine	G1
1,6,7,11	Vascular Plant	Marshallia trinervia	Large-flowered Barbara's buttons	G2
5	Vascular Plant	Matelea floridana	Broadleaf Barbara's buttons	G3
5	Vascular Plant	Matelea pubiflora	Florida milkving	G2
5	Vascular Plant	Micranthemum glomeratum	Ridge johnnyberry	G1
1	Vascular Plant	Minuartia alabamensis	Manatee mudflower	G3?
4,11	Vascular Plant	Minuartia godfreyi	Alabama Sandwort	G2
1,3,4,5,8,11,12	Vascular Plant	Monotropsis odorata	Godfrey's stitchwort	G1
11	Vascular Plant	Muhlenbergia torreyana	Sweet Pinesap	G3
1,5,7,11	Vascular Plant	Myriophyllum laxum	Palo de cera	G1
5	Vascular Plant	Najas filifolia	Loose watermilfoil	G3
11	Vascular Plant	Narthecium americanum	Needleleaf waternymph	G1
5	Vascular Plant	Nemastylis floridana	Bog Asphodel	G2
1	Vascular Plant	Neviusia alabamensis	Fallflowering pleatleaf	G2
5	Vascular Plant	Nolina atopocarpa	Alabama snow-wreath	G2
11	Vascular Plant	Nuphar saggitifolia	Florida beargrass	G3
5	Vascular Plant	Nyssa ursina	Narrowleaf Cowlily	G3
1	Vascular Plant	Onosmodium sp. nov. "decipiens"	Bear tupelo	G2Q
5,11	Vascular Plant	Oxypolis ternata	A false gromwell	G1G2
11	Vascular Plant	Parietaria praetermissa	Piedmont cowbane	G3
5,11	Vascular Plant	Parnassia caroliniana	Large-seed Pellitory	G3G4
5	Vascular Plant	Paronychia rugelii	Carolina grass of parnassus	G3
2,8	Vascular Plant	Paxistima canbyi	Rugel's nailwort	G2
3,4,11	Vascular Plant	Penstemon smallii	Canby's mountain-lover	G2
7	Vascular Plant	Penstemon tenuiflorus	Small's beardtongue	G3
5	Vascular Plant	Persea humilis	White-flowered beardtongue	G3?
17	Vascular Plant	Phacelia ranunculacea	Silk bay	G3
8	Vascular Plant	Phlox buckleyi	Oceanblue phacelia	G3G4
5	Vascular Plant	Phlox floridana	Swordleaf phlox	G2
5	Vascular Plant	Phoebanthus tenuifolius	Florida phlox	G1G2Q
5	Vascular Plant	Physalis arenicola	Pineland false sunflower	G3
5	Vascular Plant	Physalis carpenterii	Cypresshead groundcherry	G3?
5	Vascular Plant	Physostegia godfreyi	Carpenter's groundcherry	G3
1,5,12	Vascular Plant	Pieris phillyreifolia	Apalachicola false dragonhead	G3
5	Vascular Plant	Pinckneya bracteata	Mountain clearweed	G1
1,5,7	Vascular Plant	Pinguicula planifolia	Fevertree	G3G4

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1,5,7	Vascular Plant	Pinguicula primuliflora	Chapman's butterwort	G3?
5	Vascular Plant	Pityopsis flexuosa	Southern butterwort	G3G4
1,5	Vascular Plant	Pityopsis oligantha	Zigzag silkgrass	G3
1,5,11,12	Vascular Plant	Plantago sparsiflora	Coastal-Plain golden-aster	G2G4
1,5,6,11,12	Vascular Plant	Platanthera integra	Pineland plantain	G3
1,2,3,4,11	Vascular Plant	Platanthera integrilabia	Yellow fringeless orchid	G3G4
8,11	Vascular Plant	Poa paludigena	White fringeless orchid	G2G3
1,5,7,11	Vascular Plant	Polygala hookeri	Bog bluegrass	G3
5	Vascular Plant	Polygala leptostachys	Hooker's milkwort	G3
5	Vascular Plant	Polygonella macrophylla	Slender spike milkwort	G3G4
11	Vascular Plant	Polygonum glaucum	Largeleaf jointweed	G2
1,3	Vascular Plant	Polymnia laevigata	Cossatot Mountain leafcup	G1
8	Vascular Plant	Potamogeton hillii	Tennessee leafcup	G3
4,8	Vascular Plant	Potamogeton tennesseensis	Hill's pondweed	G3
6	Vascular Plant	Prenanthes barbata	Tennessee pondweed	G2
4,8,11	Vascular Plant	Prenanthes roanensis	Barbed rattlesnakeroot	G2
5,6,7,12	Vascular Plant	Pteroglossaspis ecristata (=Eulophia ecristata)	Sintenis' guava	G1
4,11	Vascular Plant	Pycnanthemum beadlei	Giant Orchid	G2
5	Vascular Plant	Pycnanthemum floridanum	Beadle's mountain mint	G2G4
8,11	Vascular Plant	Pycnanthemum torrei	Florida mountainmint	G3
1,5	Vascular Plant	Quercus arkansana	Mapleleaf oak	G1
3,7,12	Vascular Plant	Quercus oglethorpensis	Dwarf Post Oak	G1
11,12	Vascular Plant	Rhexia aristosa	Tortugo prieto	G2
5	Vascular Plant	Rhexia parviflora	Awnpetal meadow-beauty	G3
1,5	Vascular Plant	Rhexia salicifolia	White meadowbeauty	G2
1,5,7	Vascular Plant	Rhododendron austrinum	Panhandle meadowbeauty	G2
11	Vascular Plant	Rhododendron vaseyi	Orange azalea	G3
5	Vascular Plant	Rhynchosia michauxii	Pinkshell azalea	G3
5,11	Vascular Plant	Rhynchospora breviseta	Michaux's snoutbean	G3?
1,5,7	Vascular Plant	Rhynchospora crinipes	Shortbristle beaksedge	G3G4
1,5,6,7	Vascular Plant	Rhynchospora macra	Hairy peduncled beakrush	G1
1,5,11	Vascular Plant	Rhynchospora pleiantha	Large beakrush	G3
1,11	Vascular Plant	Rhynchospora thornei	Coastal beaksedge	G2
1,11	Vascular Plant	Robinia viscosa	Thorne's beaksedge	G1G2
11,12	Vascular Plant	Robinia viscosa var.hartwegii	Clammy locust	G3
4	Vascular Plant	Rosa obtusiuscula	Hartweg's locust	G3T1
1	Vascular Plant	Rudbeckia auriculata	Appalachian Valley rose	G1G3Q
5	Vascular Plant	Rudbeckia graminifolia	Eared coneflower	G1
1,12	Vascular Plant	Rudbeckia heliopsidis	Grassleaf coneflower	G3
5	Vascular Plant	Rudbeckia nitida	Sunfacing coneflower	G2
6	Vascular Plant	Rudbeckia scabrifolia	Shiny coneflower	G3?
1,8,11	Vascular Plant	Rudbeckia triloba var pinnatiloba	Sabine coneflower	G2
1,5,7	Vascular Plant	Ruellia noctiflora	Pinnate-lobed black-eyed Susan	G4T2?
4,11	Vascular Plant	Rugelia nudicaulis	Night flowering ruellia	G2
1,3,11	Vascular Plant	Sabatia capitata	Rugel's Indianplantain	G3
11	Vascular Plant	Sagittaria graminea var. weatherbiana	Appalachian rose gentian	G2
5	Vascular Plant	Salix floridanum	Chapman's Arrowhead	G5T2
1,5,7	Vascular Plant	Sarracenia leucophylla	Florida willow	G2

1,7	Vascular Plant	Sarracenia rubra ssp. wherryi	Crimson pitcherplant	G3
4,8,11	Vascular Plant	Saxifraga caroliniana	Wherry's pitcherplant	G3
1,2,3,5,6,7	Vascular Plant	Schisandra glabra	Carolina saxifrage	G2
5	Vascular Plant	Schoenocaulon dubium	Bay starvine	G3
5	Vascular Plant	Schoenolirion albiflorum	Florida feathershank	G3?
6	Vascular Plant	Schoenolirion wrightii	White sunnybells	G3
1	Vascular Plant	Scutellaria alabamensis	Texas sunnybell	G3
11	Vascular Plant	Scutellaria altamaha	Alabama skullcap	G2
4,11	Vascular Plant	Scutellaria arguta	A skullcap	G2G3
5	Vascular Plant	Scutellaria glabriuscula	hairy skullcap	G2?Q
11	Vascular Plant	Scutellaria pseudoserrata	Georgia skullcap	G2?
2,4,11	Vascular Plant	Scutellaria saxatilis	A Skullcap	G3
1,4	Vascular Plant	Sedum nevii	Rock skullcap	G3
3,11	Vascular Plant	Senecio millefolium	Nevius' stonecrop	G3
11	Vascular Plant	Shortia galacifolia var. brevistyla	Piedmont ragwort	G2
2,3,11,12	Vascular Plant	Shortia galacifolia var. galacifolia	Northern Oconee bells	G2T1Q
4,8	Vascular Plant	Sida hermaphrodita	Southern Oconee bells	G2T2
5	Vascular Plant	Sideroxylon alachuense	Virginia fanpetals	G2
5	Vascular Plant	Sideroxylon tenax	Silver buckthorn	G1
1,2,3,4,7,8,11	Vascular Plant	Silene ovata	Tough bully	G3?
1,2	Vascular Plant	Silene regia	Blue Ridge catchfly	G2G3
5	Vascular Plant	Silphium simpsonii	Scarlet Catchfly	G3
1	Vascular Plant	Silphium sp. nov. "glutinosum"	Simpson's rosinweed	G3?Q
5	Vascular Plant	Sisyrinchium xerophyllum	A rosinweed	G2
11	Vascular Plant	Solidago plumosa	Ouachita Mountain goldenrod	G3
11	Vascular Plant	Solidago pulchra	Plumed goldenrod	G1
3,11	Vascular Plant	Solidago simulans	Carolina goldenrod	G3
11	Vascular Plant	Solidago villosacarpa	Fall goldenrod	G1
11	Vascular Plant	Solidago verna	Coastal goldenrod	G1Q
5	Vascular Plant	Spigelia loganiodes	Spring-flowering goldenrod	G3
5,7,11	Vascular Plant	Spiranthes longilabris	Florida pinkroot	G1G2
1,5,12	Vascular Plant	Sporobolus curtisii	Giant spiral ladies'-tresses	G3
1,5	Vascular Plant	Sporobolus floridanus	Pineland Dropseed	G3
12	Vascular Plant	Sporobolus pinetorum	Florida dropseed	G3
5	Vascular Plant	Stachydeoma graveolens	Carolina Dropseed	G3
4,11	Vascular Plant	Stachys clingmanii	Mock pennyroyal	G2
5	Vascular Plant	Stylisma abdita	Pineoak jewelflower	G2
1	Vascular Plant	Talinum calcaricum	Showy dawnflower	G2G3
1	Vascular Plant	Talinum mengesii	Limestone fameflower	G3
1,5	Vascular Plant	Tephrosia mohrii	Menge's fameflower	G3
1,11	Vascular Plant	Thalictrum macrostylum (=T.subrotundum)	Arkansas meadow-rue	G2Q
1,2	Vascular Plant	Thalictrum mirabile	Piedmont meadowrue	G1G2Q
1,2,4,11	Vascular Plant	Thaspium pinnatifidum	Little Mountain meadowrue	G2G3Q
4,11	Vascular Plant	Thermopsis mollis var. fraxinifolia	Cutleaved meadow parsnip	G3?
1,11	Vascular Plant	Tofieldia glabra	Ashleaf goldenbanner	G4?T3?
1,5,6,7	Vascular Plant	Tridens carolinianus	Ozark spiderwort	G3
7	Vascular Plant	Trillium foetidissimum	Carolina fluffgrass	G3
1,12	Vascular Plant	Trillium lancifolium	Fetid trillium	G3

3	Vascular Plant	Trillium pusillum	Lanceleaf trillium	G3
8	Vascular Plant	Trillium pusillum var. monticulum	Least trillium	G3
2,11	Vascular Plant	Trillium pusillum var. pusillum	Ozark least trillium	G3T3
1,3,4,11,12	Vascular Plant	Trillium rugelii	Least trillium	G3T2
1,3,4,11,12	Vascular Plant	Trillium simile	Illscented trillium	G3
3,4,11	Vascular Plant	Tsuga caroliniana	Texas Trillium	G3T2
7	Vascular Plant	Uvularia floridana	Ortiga colorada	G1
11	Vascular Plant	Verbena riparia	Palmer's cornsalad	G3
5	Vascular Plant	Verbesina chapmanii	Riverbank vervain	G1G3
5	Vascular Plant	Verbesina heterophylla	Chapman's crownbeard	G3
5	Vascular Plant	Vicia ocalensis	Narrowleaf ironweed	G3
11	Vascular Plant	Viola appalachiensis	Ocala vetch	G1
2,8	Vascular Plant	Vitis rupestris	Appalachian violet	G3
3,11,12	Vascular Plant	Waldsteinia lobata	Sand grape	G3
5	Vascular Plant	Warea sessilifolia	Piedmont barren strawberry	G2
1,5,7	Vascular Plant	Xyris chapmanii	Schwaneck's logwood	G1
1,5,6,7	Vascular Plant	Xyris drummondii	Chapman's yellow-eyed grass	G3
1,5	Vascular Plant	Xyris isoetifolia	Drummond's yelloweyed grass	G3
1,5	Vascular Plant	Xyris longisepala	Quillwort yelloweyed grass	G2
5	Vascular Plant	Xyris louisianica	Kral's yelloweyed grass	G2
1,5,6,7	Vascular Plant	Xyris scabrifolia	Louisiana yelloweyed grass	G3
5	Vascular Plant	Zephyranthes simpsonii	Harper's yelloweyed grass	G3

TABLE 2: REGIONAL FORESTER SENSITIVE SPECIES – REGION 9

National Forest Designations: WM = White Mountain National Forest (NH,ME), WN = Wayne National Forest (OH), MO = Monongahela National Forest (WV), AL = Allegheny National Forest (PA), GM = White Mountain National Forest (VT), HO = Hoosier National Forest (IN), FL = Finger Lakes (NY), HM = Huron-Manistee National Forest (MI), HI = Hiawatha National Forest (MI), OT = Ottawa National Forest (MI)

National Forest	Group	Scientific Name	Common Name	G-Rank
HO, WM	Mammal	Lutra canadensis	River Otter	G5
HO, WM	Mammal	Lynx rufus	Bobcat	G5
MO	Mammal	Microtus chrotorrhinus carolinensis	Southern Rock Vole	G4T3
MO, GM, WM	Mammal	Myotis leibii	Eastern Small-footed Myotis	G3
AL	Mammal	Myotis septentrionalis	Long-eared Myotis	G4
HO, MO	Mammal	Neotoma magister	Allegheny Woodrat	G3G4
HO, WN	Mammal	Nycticeius humeralis	Evening Bat	G5
AL	Mammal	Sorex palustris	Water Shrew	G5
MO	Mammal	Sorex palustris punctulatus	Southern Water Shrew	G5T3
WM	Mammal	Synaptomys borealis sphagnicola	Northern Bog Lemming	G4T3Q
HO	Mammal	Taxidea taxus	American Badger	G5
WN	Mammal	Ursus americanus	Black Bear	G5
MO, FL, HM, HI, OT	Bird	Accipiter gentilis	Northern Goshawk	G5
HO, WN, FL, HM	Bird	Ammodramus henslowii	Henslow's Sparrow	G4
HI	Bird	Ammodramus leconteii	Le Conte's Sparrow	G4
HM, HI	Bird	Asio flammeus	Short-eared Owl	G5
FL	Bird	Bartramia longicauda	Upland Sandpiper	G5
HM, HIOT	Bird	Buteo lineatus	Red-shouldered Hawk	G5
GM, WM	Bird	Catharus bicknelli	Bicknell's Thrush	G4
WM, HI, OT	Bird	Chlidonias niger	Black Tern	G4
FL	Bird	Circus cyaneus	Northern Harrier	G5
HM, HI	Bird	Coturnicops noveboracensis	Yellow Rail	G4
HM, HI, OT	Bird	Cygnus buccinator	Trumpeter Swan	G4
HO, WN, HM	Bird	Dendroica cerulea	Cerulean Warbler	G4
HM, HI	Bird	Dendroica discolor	Prairie Warbler	G5
AL	Bird	Empidonax flaviventris	Yellow-bellied Flycatcher	G5

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HM	Bird	Falcipennis canadensis	Spruce Grouse	G5
MO, GM, WM, HI, OT	Bird	Falco peregrinus anatum	American Peregrine Falcon	G4T3
GM, WM, HM, HI	Bird	Gavia immer	Common Loon	G5
HO, MO, HM, HI	Bird	Lanius ludovicianus migrans	Migrant Loggerhead Shrike	G4T3Q
HM, HI	Bird	Nycticorax nycticorax	Black-crowned Night-heron	G5
HM, HI, OT	Bird	Oporornis agilis	Connecticut Warbler	G4
HI, OT	Bird	Picoides arcticus	Black-backed Woodpecker	G5
HM	Bird	Rallus elegans	King Rail	G4G5
HI	Bird	Sterna caspia	Caspian Tern	G5
HI	Bird	Sterna hirundo	Common Tern	G5
HM, HI	Bird	Tympanuchus phasianellus	Sharp-tailed Grouse	G4
GM	Amphibian	Ambystoma jeffersonianum	Jefferson Salamander	G4
HO, MO	Amphibian	Aneides aeneus	Green Salamander	G3G4
WN, MO	Amphibian	Cryptobranchus alleganiensis	Hellbender	G3G4
OT	Amphibian	Hemidactylium scutatum	Four-toed Salamander	G5
HO	Amphibian	Scaphiopus holbrookii holbrookii	Eastern Spadefoot Toad	G5T5
GM, WM, WM, OT	Reptile	Clemmys insculpta	Wood Turtle	G4
FL	Reptile	Clemmys muhlenbergii	Bog Turtle	G3
HO, HM	Reptile	Clonophis kirtlandii	Kirtland's Snake	G2
HO, WN, MO, AL	Reptile	Crotalus horridus	Timber Rattlesnake	G4
HM, HI	Reptile	Emydoidea blandingii	Blanding's Turtle	G4
HM	Reptile	Sistrurus catenatus catenatus	Eastern Massasauga	G3G4T3T4
HM	Reptile	Terrapene carolina carolina	Eastern Box Turtle	G5T5
HO, HM, HI, OT	Fish	Acipenser fulvescens	Lake Sturgeon	G3G4
HO	Fish	Amblyopsis spelaea	Northern Cavefish	G3
HO, WN	Fish	Ammocrypta pellucida (= Etheostoma pellucidum)	Eastern Sand Darter	G3
MO, HM, OT	Fish	Clinostomus elongatus	Redside Dace	G4
HM	Fish	Coregonus artedi	Cisco Or Lake Herring	G5
AL	Fish	Erimystax x-punctatus	Gravel Chub	G4
WN	Fish	Erimyzon sucetta	Lake Chubsucker	G5
HO	Fish	Etheostoma camurum	Bluebreast Darter	G4
HO, AL	Fish	Etheostoma maculatum	Spotted Darter	G2
MO	Fish	Etheostoma osburni	Candy Darter	G3
AL	Fish	Etheostoma tippecanoe	Tippecanoe Darter	G3
WN	Fish	Ichthyomyzon bdellium	Ohio Lamprey	G3G4
AL	Fish	Ichthyomyzon greeleyi	Mountain Brook Lamprey	G3G4
MO	Fish	Margariscus margarita	Pearl Dace	G5
HM	Fish	Moxostoma carinatum	River Redhorse	G4
HM	Fish	Moxostoma valenciennesi	Greater Redhorse	G4
HM	Fish	Notropis anogenus	Pugnose Shiner	G3
MO	Fish	Notropis scabriceps	New River Shiner	G4
AL, HM	Fish	Percina copelandi	Channel Darter	G4
AL	Fish	Percina evides	Gilt Darter	G4
MO	Fish	Percina gymnocephala	Appalachian Darter	G4
AL	Fish	Percina macrocephala	Longhead Darter	G3
HM	Fish	Percina shumardi	River Darter	G5
MO	Fish	Phenacobius teretulus	Kanawha Minnow	G3G4
MO	Fish	Rhinichthys bowersi	Cheat Minnow	G1G2Q
MO	Mollusk	Alasmidonta marginata	Elktoe	G4
GM	Mollusk	Alasmidonta varicosa	Brook Floater	G3
HO	Mollusk	Arcidens confragosus	Rock Pocketbook	G4
HI	Mollusk	Catinella exile	Land Snail	G1G2
HO	Mollusk	Epioblasma triquetra	Snuffbox	G3
HI	Mollusk	Euconulus alderi	Land Snail	G?
MO	Mollusk	Fontigens tartarea	Organ Cavesnail	G2
AL	Mollusk	Fusconaia subrotunda	Longsolid	G3
HO	Mollusk	Glyphyalinia cryptomphala	Thin glyph	G4
HO	Mollusk	Lampsilis fasciola	Wavyrayed Lampmussel	G4
HO	Mollusk	Lampsilis teres	Yellow Sandshell	G5
GM, OT	Mollusk	Lasmigona compressa	Creek Heelsplitter	G5
MO, FL	Mollusk	Lasmigona subviridis	Green Floater	G3
HO	Mollusk	Ligumia recta	Black Sandshell	G5
HM	Mollusk	Oarisma powesheik	Poweshiek Skipper	G2
HO, WN	Mollusk	Obovaria subrotunda	Round Hickorynut	G4
HO	Mollusk	Patera laevior	Smooth bladetooth	G4
HO	Mollusk	Pheocyclops indiana	Indiana groundwater copepod	G1
HO	Mollusk	Pleurobema cordatum	Ohio Pigtoe	G3
HO	Mollusk	Pleurobema rubrum	Pyramid Pigtoe	G2
HO	Mollusk	Ptychobranchus fasciolaris	Kidneyshell	G4

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HO	Mollusk	Quadrula cylindrica cylindrica	Rabbitsfoot	G3T3
HO, WN	Mollusk	Simpsonaias ambigua	Salamander Mussel	G3
HO	Mollusk	Toxolasma lividus	Purple Liliput	G2
HO, WN	Mollusk	Toxolasma parvus	Lilliput	G5
HI	Mollusk	Vallonia gracilicosta albula	Snail	G?T?
	Mollusk	Venustaconcha ellipsiformis	Ellipse	G3G4
HI	Mollusk	Vertigo bollesiana	Delicate Vertigo	G3
HI	Mollusk	Vertigo morsei	Six Whorl Vertigo	G?
HI	Mollusk	Vertigo paradoxa	Mystery Vertigo	G2G4
WN	Mollusk	Villosa lienosa	Little Spectaclecase	G5
GM	Insect	Aeshna tuberculifera	Black-tipped Darner	G4
GM	Insect	Aeshna verticalis	Green-striped Darner	G5
HO	Insect	Amblyscirtes belli	Bell's Roadside Skipper	G4
HM	Insect	Appalachia arcana	Michigan Bog Grasshopper	G2G3
GM	Insect	Arigomphus furcifer	Lilypad Clubtail	G5
HO	Insect	Arrhopalites ater	A Cave Obligate Springtail	G?
HO	Insect	Arrhopalites carolynae	A Cave Springtail	G2G3
HO	Insect	Arrhopalites lewisi	A Cave Obligate Springtail	G?
HO	Insect	Arrhopalites whitesidei	Whiteside's Springtail	G?
HM	Insect	Atrytonopsis hianna	Dusted Skipper	G4G5
HO	Insect	Batrisodes sp. Krekeleri?	Indiana Cave Ant Beetle	G1
WM	Insect	Boloria chariclea montina (=Boloria titania montinus)	White Mountain Fritillary	G5T2
HO	Insect	Calephelis mutica	Swamp Metalmark	G3G4
GM	Insect	Calopteryx amata	Superb Jewelwing	G4
GM	Insect	Cicindela marginipennis	Cobblestone Tiger Beetle	G2G3
HO	Insect	Cycnia inopinatus	A Tiger Moth	G4
HO	Insect	Dorycephalus sp. Either D.balli or D.delongi	Shovel-headed Leafhopper	G4
HO	Insect	Dorydiella kansana Kansas	Preacher	G?
HM	Insect	Eacles imperialis pini	The Imperial Moth	G5T3
HO	Insect	Entomobrya socia	A cave obligate springtail	G?
HO	Insect	Erynnis martialis	Mottled Dusky Wing	G3G4
WM	Insect	Erynnis persius	Persius Duskywinged	G5
WN	Insect	Euchloe olympia	Olympia Marble	G4G5
HO	Insect	Fitchella robertson	Robertson's Elephant Hopper	G2G3
HO	Insect	Flexamia reflexus	A Leafhopper	G?
AL, GM	Insect	Gomphus (=Phanogomphus) descriptus	Harpoon Clubtail	G4
AL, GM	Insect	Gomphus adelphus	Mustached Clubtail	G4
AL	Insect	Gomphus fraternus	Midland Clubtail	G5
AL	Insect	Gomphus quadricolor	Rapids Clubtail	G3G4
AL	Insect	Gomphus viridifrons	Green-faced Clubtail	G3
AL	Insect	Helocordulia uhleri	Uhler's Sundragon	G5
HM	Insect	Hesperia ottoe	Ottoe Skipper	G3G4
HO	Insect	Hypogastrura gibbosus	A Springtail	G?
HM	Insect	Incisalia henrici	Henry's Elfin	G5
HM	Insect	Incisalia irus	Frosted Elfin	G3
HO	Insect	Isotoma anglica	A Springtail	G?
HO	Insect	Isotoma truncata	A Springtail	G?
GM	Insect	Lanthus vernalis	Southern Pygmy Clubtail	G4
HM	Insect	Lepyronia gibbosa	Hill-prairie Spittlebug	G3G4
GM	Insect	Lestes eurinus	Amber-winged Spreadwing	G4
HI, OT	Insect	Lycaeides idas nabokovi	Nabokov's (or Northern) Blue	G5TU
WN	Insect	Macromia wabashensis	Wabash River Cruiser	G1G3Q
HM	Insect	Merolonche dolli	Doll's Merolonche	G3G4
WM	Insect	Oenesis melissa semidae	White Mountain Butterfly	G5T2
HO	Insect	Onychiurus reluctus	A Springtail	G?
HO	Insect	Onychiurus subtenuis	Slender Springtail	G3
AL, GM	Insect	Ophiogomphus (=Ophionurus) mainensis	Maine Snaketail	G4
OT	Insect	Ophiogomphus howei	Pygmy Snaketail	G3
HO	Insect	Papaipema astuta	Yellow Stoneroot Borer	G3G4
HO	Insect	Papaipema beeriana	Blazing Star Stem Borer	G3
HO	Insect	Papaipema mardinidens	A Borer Moth	G4
HO	Insect	Papaipema rutila	Mayapple Borer Moth	G4
HO	Insect	Parasa indetermina	A Moth	G4
HO	Insect	Pieris virginiensis	West Virginia White	G3G4
HO	Insect	Polyamia herbida		G?
HO	Insect	Proisotoma libra	Springtail	G2
MO	Insect	Pseudanophthalmus fuscus	A Cave Beetle	G2G3
MO	Insect	Pseudanophthalmus hadenoecus	Timber Ridge Cave Beetle	G1
MO	Insect	Pseudanophthalmus hypertrichosis	A Cave Beetle	G3

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MO	Insect	Pseudanophthalmus montanus	Dry Fork Valley Cave Beetle	G1
HO	Insect	Pseudanophthalmus tenuis (=stricticollis) jeanneli	A Troglobitic Ground Beetle	G3T1T2
HO	Insect	Pseudanophthalmus youngi youngi	Young's Cave Ground Beetle	G2T1T2
MO	Insect	Pseudosinella certa	Gandy Creek Cave Springtail	G1
HO	Insect	Pseudosinella collina	A springtail	G?
MO	Insect	Pseudosinella gisini	A Springtail	G3G4
HM	Insect	Pygarctia spraguei	Sprague's Pygarctic	G3G4
WN, HM	Insect	Pyrgus wyandot	Southern Grizzled Skipper	G2
HM	Insect	Schinia indiana	Phlox Moth	GU
HO	Insect	Schinia jaguarina	Jaguar Flower Moth	G4
MO	Insect	Sinella agna	A Springtail	G2G3
HO	Insect	Sinella alata Wingless	Winged Cave Springtail	G3
AL, GM	Insect	Somatochlora elongata	Ski-tailed Emerald Dragonfly	G5
GM	Insect	Somatochlora forcipata	Forcipate Emerald	G5
HI	Insect	Somatochlora incurvata	Warpaint Emerald	G4
GM	Insect	Somatochlora minor	Ocellated Emerald	G5
HM	Insect	Spartiniphaga inops	Spartina Borer Moth	G3G4
MO	Insect	Speyeria diana	Diana Fritillary	G3
HM	Insect	Speyeria idalia	Regal Fritillary	G3
MO	Insect	Sphalloplana culveri	Culver's Planarium	G1
HM	Insect	Stenelmis douglasensis	Douglas Stenelmis Riffle Beetle	G1G3
AL	Insect	Stylurus scudderi	Zebra Clubtail	G4
HO	Insect	Tomocerus dubius	A Springtail	G?
HM, HI	Insect	Trimerotropis huroniana	Lake Huron Locust	G2G3
HO	Invertebrate	Anahita punctulata	Southeastern wandering spider	G4
HO	Invertebrate	Apochthonius indianensis	A pseudoscorpion	G3
MO	Invertebrate	Apochthonius paucispinosus	Dry Fork Valley Cave Pseudoscorpion	G1
MO	Invertebrate	Caecidotea cannulus	An Isopod	G2
MO	Invertebrate	Caecidotea holsingeri	Holsinger's Cave Isopod	G3
MO	Invertebrate	Caecidotea simonini	An Isopod	G1
MO	Invertebrate	Caecidotea sinuncus	An Isopod	G1
MO	Invertebrate	Cambarus nerterius	An Underground Crayfish	G2G3
HO	Invertebrate	Cauloxenus stygius	A Cave Obligate Copepod	G3
HO	Invertebrate	Conotyla bollmani	Bollman's Cave Millepede	G3
HO	Invertebrate	Crangonyx packardi	Packard's Cave Amphipod	G3
HO	Invertebrate	Diacycops jeanneli jeanneli	A cave obligae copepod	G3G4
HO	Invertebrate	Erebomaster flavescens	Golden Cave Harvestman	G1G2
HO	Invertebrate	Hesperochernes mirabilis	Wonderful Pseudoscorpion	G3G4
HO	Invertebrate	Kleptochthonius griseomanus		G1
HO	Invertebrate	Kleptochthonius packardi	A cave obligate pseudoscorpion	G3
MO	Invertebrate	Macrocotyla hoffmasteri	Hoffmaster's Cave Flatworm	G2G3
HO	Invertebrate	Megacyclops donnaldsoni	Campground Cave Copepod	G3G4
HO	Invertebrate	Nesticus carteri	Carter's Cave Spider	G?
HO	Invertebrate	Orconectes indianensis	Indiana Crayfish	G2G3
HO	Invertebrate	Orconectes inermis inermis	Northern Cave Crayfish	G4T3T4
HO	Invertebrate	Porhomma cavernicola	Cavernicolous Sheet-web Spider	G4G5
HO	Invertebrate	Pseudocandona jeanneli	Jeannel's cave ostracod	G1G2
MO	Invertebrate	Pseudotremia fulgida	Greenbrier Valley Cave Millipede	G2G3
HO	Invertebrate	Pseudotremia indianae	A cave obligate millipede	G3
MO	Invertebrate	Pseudotremia lusciosa	Germany Valley Cave Millipede	G1
MO	Invertebrate	Pseudotremia princeps	South Branch Valley Cave Millipede	G1
HO	Invertebrate	Pseudotremia reynoldsae	Reynolds' cave milliped	G1
HO	Invertebrate	Pseudotremia salisae	A cave obligate millipede	G1G2
HO	Invertebrate	Sabacon cavicolens	Cavernicolous harvestman	G?
HO	Invertebrate	Scytonotus granulatus	Granulated Millipede	G5
HO	Invertebrate	Sphalloplana weingartneri	Weingartner's Cave flatworm	G2G3
MO	Invertebrate	Stygobromus culveri	Culver's Cave Amphipod	G1G2
MO	Invertebrate	Stygobromus emarginatus	Greenbrier Cave Amphipod	G3
MO	Invertebrate	Stygobromus nanus	Pocahontas Cave Amphipod	G1
MO	Invertebrate	Stygobromus parvus	Minute Cave Amphipod	G1G2
HO	Invertebrate	Talanites echinus	A gnaphosid spider	G?
MO	Invertebrate	Trichopetalum krekeleri	A Millipede	G1
MO	Invertebrate	Trichopetalum weyeriensis	Grand Caverns Blind Cave Millipede	G3
MO	Invertebrate	Trichopetalum whitei	Luray Caverns Blind Cave Millipede	G2G3Q
MO	Vascular Plant	Abies fraseri	Fraser Fir	G2
MO	Vascular Plant	Aconitum reclinatum	White Monkshood	G3
HO	Vascular Plant	Aconitum uncinatum	Blue Monkshood	G4
HI	Vascular Plant	Adlumia fungosa	Climbing Fumitory	G4
HM	Vascular Plant	Agoseris glauca	Pale False-dandelion	G5
MO, GM	Vascular Plant	Agrostis mertensii	Arctic Bentgrass	G5

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FL	Vascular Plant	Allium cernuum	Nodding Onion	G5
MO	Vascular Plant	Allium oxyphilum	Lillydale Onion	G2Q
HI	Vascular Plant	Amerorchis rotundifolia	Round-leaved Orchis	G5
MO	Vascular Plant	Arabis patens	Spreading Rockcress	G3
HM, HI	Vascular Plant	Armoracia lacustris	Lake-cress	G4?
WM	Vascular Plant	Arnica lanceolata	Arnica	G3
HM	Vascular Plant	Asclepias purpurascens	Purple Milkweed	G4G5
HI	Vascular Plant	Asplenium rhizophyllum	Walking-fern Spleenwort	G5
HI	Vascular Plant	Asplenium trichomanes-ramosum	Green Spleenwort	G4
HM	Vascular Plant	Aster sericeus	Western Silvery Aster	G5
HI	Vascular Plant	Astragalus canadensis	Canadian Milkvetch	G5
MO	Vascular Plant	Astragalus neglectus	Cooper's Milkvetch	G4
GM	Vascular Plant	Aureolaria pedicularia	Fernleaf Yellow False-foxglove	G5
HO	Vascular Plant	Bacopa rotundifolia	Roundleaf Water-hyssop	G5
HI	Vascular Plant	Beckmannia syzigachne	American sloughgrass	G5
WM	Vascular Plant	Betula minor	Dwarf White Birch	G3G4Q
GM	Vascular Plant	Blephilia hirsuta	Hairy Woodmint	G5?
HI	Vascular Plant	Botrychium campestre	Prairie Dunewort	G3
MO	Vascular Plant	Botrychium lanceolatum	Triangle Grape-fern	G5
MO	Vascular Plant	Botrychium lanceolatum var angustisegmentum	Lance-leaf Grape-fern	G5T4
HI	Vascular Plant	Botrychium michiganense (hesperium)	A Moonwort	G?
HI	Vascular Plant	Botrychium mormo	Goblin Fern	G3
MO, HI	Vascular Plant	Botrychium oneidense	Blunt-lobed Grapefern	G4Q
HI	Vascular Plant	Botrychium pallidum	Pale Moonwort	G3
HI	Vascular Plant	Botrychium rugulosum (=ternatum)	Ternate Grape Fern	G3
HI	Vascular Plant	Botrychium spathulatum	Spoon-leaf Moonwort	G3
HM	Vascular Plant	Bouteloua curtipendula	Side-oats Grama	G5
HO	Vascular Plant	Buchnera americana	Bluehearts	G5?
WM, OT	Vascular Plant	Calamagrostis lacustris	Pond Reedgrass	G3Q
GM	Vascular Plant	Calamagrostis stricta ssp inexpansa	New England Northern Reed Grass	G5T5
HI	Vascular Plant	Callitriche hermaphroditica	Autumnal Water-starwort	G5
HI, OT	Vascular Plant	Calypso bulbosa	Fairy Slipper	G5
WM	Vascular Plant	Cardamine bellidifolia	Alpine Bitter-cress	G5
OT	Vascular Plant	Cardamine maxima	Large Toothwort	G5Q
GM	Vascular Plant	Cardamine parviflora	Small-flower Bitter-cress	G5
GM	Vascular Plant	Carex aestivalis	Summer Sedge	G4
GM	Vascular Plant	Carex aquatilis	Water Sedge	G5
GM	Vascular Plant	Carex argyrantha	Hay Sedge	G5
GM	Vascular Plant	Carex atlantica	Prickly Bog Sedge	G5
WM	Vascular Plant	Carex baileyi	Bailey's Sedge	G4
GM	Vascular Plant	Carex bigelowii	Bigelow Sedge	G5
HI	Vascular Plant	Carex concinna	Beautiful Sedge	G4G5
WM	Vascular Plant	Carex cumulata	Clustered Sedge (piled-up Sedge)	G4?
FL	Vascular Plant	Carex decomposita	Epiphytic Sedge	G3
GM	Vascular Plant	Carex foenea (=aenea)	Bronze Or Dry-spike Sedge	G5
HI	Vascular Plant	Carex heleonastes	Hudson Bay Sedge	G4
FL	Vascular Plant	Carex hitchcockiana	Hitchcock's Sedge	G5
WN	Vascular Plant	Carex juniperorum	Juniper Sedge	G2
GM	Vascular Plant	Carex lenticularis	Shore Sedge	G5
FL	Vascular Plant	Carex lupuliformis	False Hop Sedge	G4
GM	Vascular Plant	Carex michauxiana	Michaux Sedge	G5
HI	Vascular Plant	Carex novae-angliae	New England Sedge	G5
GM	Vascular Plant	Carex schweinitzii	Schweinitz's Sedge	G3
GM, HI	Vascular Plant	Carex scirpoidea	Bulrush Sedge	G5
AL, WM, HI	Vascular Plant	Carex wiegandii	Wiegand's Sedge	G3
FL	Vascular Plant	Carya laciniosa	Big Shellbark Hickory	G5
HM	Vascular Plant	Cirsium hillii	Hill's Thistle	G3
GM	Vascular Plant	Clematis occidentalis var occidentalis	Purple Clematis	G5T5
GM	Vascular Plant	Collinsonia canadensis	Canada Horse-balm	G5
GM	Vascular Plant	Conopholis americana	Squaw-root	G5
HI	Vascular Plant	Crataegus douglasii	Douglas's Hawthorn	G5
GM, HI	Vascular Plant	Cryptogramma stelleri	Fragile RockbrakeG5	G5
HM, HI	Vascular Plant	Cynoglossum virginianum (=boreale) varboreale	Northern Wild Comfrey	G5T4
HM, HI, OT	Vascular Plant	Cypripedium arietinum	Ram's-head Lady's Slipper	G3
GM	Vascular Plant	Cypripedium parviflorum var parviflorum	Small Yellow Lady's Slipper	G5T3T4
HO, GM	Vascular Plant	Cypripedium pubescens (=parviflorum varpubescens)	Large Yellow Lady's-slipper	
MO, GM	Vascular Plant	Cypripedium reginae	Showy Lady's-slipper	G4
HI	Vascular Plant	Cystopteris laurentiana	Laurentian Bladder Fern	G3

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HM	Vascular Plant	Dalibarda repens	Robin Runaway	G5
MO	Vascular Plant	Delphinium exaltatum	Tall Larkspur	G3
HO	Vascular Plant	Desmodium humifusum	Trailing Tick-trefoil	G1G2Q
GM	Vascular Plant	Desmodium paniculatum	Narrow Leaf Tick-trefoil	G5
WM	Vascular Plant	Dicentra canadensis	Squirrel-corn	G5
HO	Vascular Plant	Dichanthelium (=Panicum) yadkinense	A Panicgrass	G5T3T4Q
OT	Vascular Plant	Disporum (=Prosartes) hookeri	Hooker's Mandarin	G5
HO	Vascular Plant	Dodecatheon frenchii	French's Shootingstar	G3
GM	Vascular Plant	Draba arabisans	Rock Whitlow-grass	G4
HI	Vascular Plant	Drosera anglica	English Sundew	G5
HI	Vascular Plant	Dryopteris expansa	Spreading Woodfern	G5
GM, HI	Vascular Plant	Dryopteris filix-mas	Male Fern	G5
WM	Vascular Plant	Dryopteris goldiana	Goldie's Woodfern	G4
HM	Vascular Plant	Eleocharis atropurpurea	Purple Spikerush	G4G5
HI	Vascular Plant	Eleocharis compressa	Flat-stemmed Spike-rush	G4
HM	Vascular Plant	Eleocharis engelmannii	Engelmann Spike-rush	G4?
GM	Vascular Plant	Eleocharis intermedia	Matted Spikerush	G5
HM	Vascular Plant	Eleocharis tricostata	Three-angle Spikerush	G4
HI	Vascular Plant	Elymus glaucus	Smooth Wild-rye	G5
HI	Vascular Plant	Empetrum nigrum	Black Crowberry	G5
HO	Vascular Plant	Epigaea repens	Trailing Arbutus	G5
FL	Vascular Plant	Equisetum palustre	Marsh Horsetail	G5
HI	Vascular Plant	Erigeron hyssopifolius	Daisy Fleabane	G5
MO	Vascular Plant	Eriogonum alleni	Shalebarren Wild-buckwheat	G4
AL	Vascular Plant	Eriophorum tenellum	Rough Cotton-grass	G5
HO	Vascular Plant	Eupatorium album	White Thoroughwort	G5
GM	Vascular Plant	Eupatorium purpureum	Sweet Joe-pye Weed	G5
HM	Vascular Plant	Eupatorium sessilifolium	Upland Boneset	G5
MO	Vascular Plant	Euphorbia purpurea	Darlington's Spurge	G3
WM	Vascular Plant	Euphrasia oakesii	Oakes' Eyebright	G4
HO	Vascular Plant	Festuca paradoxa	Cluster Fescue	G5
WM	Vascular Plant	Festuca rubra ssp arctica (=var prolifera)	Proliferous Red Fescue	G?
HM	Vascular Plant	Festuca scabrella	Rough Fescue	G5
HM	Vascular Plant	Fuirena squarrosa	Hairy Umbrella-sedge	G4G5
HI	Vascular Plant	Galium brevipes	Limestone Swamp Bedstraw	G4?
HI	Vascular Plant	Galium kamtschaticum	Boreal Bedstraw	G5
AL	Vascular Plant	Gaultheria hispidula	Creeping Snowberry	G5
MO	Vascular Plant	Gaylussacia brachycera	Box Huckleberry	G3
HO, WN	Vascular Plant	Gentiana alba	Yellow Gentian	G4
WN	Vascular Plant	Gentiana villosa	Striped Gentian	G4
WM	Vascular Plant	Geocaulon lividum	Northern Comandra	G5
GM	Vascular Plant	Geum laciniatum	Rough Avens	G5
WM	Vascular Plant	Geum peckii	Mountain Avens	G2
MO	Vascular Plant	Gymnocarpium appalachianum	Appalachian Oak Fern	G3
HI	Vascular Plant	Gymnocarpium robertianum	Limestone Oak Fern	G5
HI	Vascular Plant	Helianthus mollis	Ashy Sunflower	G4G5
MO	Vascular Plant	Heuchera alba	White Alumroot	G2Q
MO	Vascular Plant	Hexalectris spicata	Crested Coralroot	G5
HI	Vascular Plant	Huperzia selago	Fir Clubmoss	G5
FL	Vascular Plant	Hydrastis canadensis	Golden-seal	G4
HM	Vascular Plant	Hypericum gentianoides	Orange-grass St. John's-wort	G5
FL	Vascular Plant	Hypericum prolificum	Shrubby St. John's-wort	G5
MO	Vascular Plant	Ilex collina	Long-stalked Holly	G3
GM	Vascular Plant	Isoetes tuckermanii	Tuckerman's Quillwort	G4?
GM	Vascular Plant	Isotria verticillata	Large Whorled Pogonia	G5
HO,WN, MO, AL, FL, GM, WM, HM, HI, OT	Vascular Plant	Juglans cinerea	Butternut	G3G4
HM	Vascular Plant	Juncus brachycarpus	Short-fruit Rush	G4G5
MO, AL	Vascular Plant	Juncus filiformis	Thread Rush	G5
HI	Vascular Plant	Juncus stygius	Moor Rush	G5
MO, GM	Vascular Plant	Juncus trifidus	Highland Rush	G5
HM, HI	Vascular Plant	Juncus vaseyi	Vasey Rush	G5?
HM	Vascular Plant	Kuhnia eupatorioides (=Brickellia eupatorioides)	False Boneset	G5
HM	Vascular Plant	Lechea pulchella	Leggett's Pinweed	G5
GM	Vascular Plant	Lespedeza hirta	Hairy Bush-clover	G5
HI	Vascular Plant	Leymus (=elymus) mollis		G4
MO	Vascular Plant	Liatris turgida	Turgid Gay-feather	G3
HO	Vascular Plant	Lilium canadense	Canada Lily	G5
FL, HM	Vascular Plant	Liparis liliifolia	Large Twayblade	G5

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GM, WM, HI	Vascular Plant	Listera auriculata	Auricled Twayblade	G3
WM	Vascular Plant	Listera convallarioides	Broad-leaved (or Broad-lipped) Twayblade	G5
WM	Vascular Plant	Listera cordata	Heartleaf Twayblade	G5
GM, HI, OT	Vascular Plant	Littorella uniflora	American Shore-grass	G5
HI	Vascular Plant	Luzula parviflora	Small-flowered Wood-rush	G5
HM	Vascular Plant	Lycopodiella appressa	Southern Bog Clubmoss	G5
HI	Vascular Plant	Lycopodiella margueritae	Northern Prostrate Clubmoss	G2
WN	Vascular Plant	Magnolia tripetala	Umbrella Magnolia	G5
HM, HI	Vascular Plant	Malaxis brachypoda	White Adder's-mouth	G4Q
MO	Vascular Plant	Marshallia grandiflora	Large-flowered Barbara's Buttons	G2
FL	Vascular Plant	Megalodonta beckii var beckii	Beck Water-marigold	G4G5T4
MO	Vascular Plant	Menyanthes trifoliata	Bog Buckbean	G5
OT	Vascular Plant	Mimulus guttatus	Common Large Monkeyflower	G5
OT	Vascular Plant	Moehringia macrophylla	Large-leaved Sandwort	G4
MO	Vascular Plant	Monarda fistulosa v. brevis (= M. f. ssp. 1)	Smoke Hole Bergamot	G5T1
HI	Vascular Plant	Muhlenbergia richardsonis	Soft-leaf Muhly	G5
GM	Vascular Plant	Muhlenbergia uniflora	Fall Dropseed Muhly Or Oneflowered Muhly	G5
HI	Vascular Plant	Myriophyllum alterniflorum	Alternate-flowered Water Milfoil	G5
GM, OT	Vascular Plant	Myriophyllum farwellii	Farwell's Water-milfoil	G5
GM	Vascular Plant	Myriophyllum humile	Low Water-milfoil	G5
OT	Vascular Plant	Nuphar (=lutea ssp pumila) pumila	Yellow Pond Lily	G5T4T5
WM	Vascular Plant	Omalotheca supina (=Gnaphalium supinum)	Alpine Cudweed	G5
HI	Vascular Plant	Omalotheca sylvatica (Gnaphalium Sylvaticum)	Woodland cudweed	G3G4
HO	Vascular Plant	Ophioglossum engelmannii	Limestone Adder's-tongue	G5
HM	Vascular Plant	Orobanche fasciculata	Clustered Broomrape	G4
HI, OT	Vascular Plant	Orobanche uniflora	One-flowered Broomrape	G5
MO, WM, HI	Vascular Plant	Oryzopsis canadensis	Canada Mountain-ricegrass	G5
WM	Vascular Plant	Osmorhiza berteroi	Chilean Sweet Cicely	G5
HO	Vascular Plant	Oxalis illinoensis	Illinois Woodsorrel	G2G3Q
HO	Vascular Plant	Pachysandra procumbems	Allegheny-spurge	G4G5
HO, GM, WM, HM, OT	Vascular Plant	Panax quinquefolius	American Ginseng	G3G4
WN	Vascular Plant	Panicum bicknellii	A Panicgrass	
WN	Vascular Plant	Panicum philadelphicum	Philadelphia Panic Grass	G5
MO, WM	Vascular Plant	Paronychia argyrocoma	Silverling	G4
MO, WM	Vascular Plant	Paronychia argyrocoma (=Paronychia argyrocoma)	White Mountain Silverling	G4
MO	Vascular Plant	Paronychia virginica v. virginica	Silvery Nailwort	G4T1Q
MO	Vascular Plant	Paxistima canbyi	Canby's Mountain Lover	G2
MO, FL	Vascular Plant	Pedicularis lanceolata	Swamp Lousewort	G5
GM	Vascular Plant	Pellaea atropurpurea	Purple-stem Cliff Brake	G5
GM	Vascular Plant	Peltandra virginica	Green Arrow-arum	G5
WM	Vascular Plant	Petasites frigidus var palmatus	Sweet Coltsfoot	G5
HI, OT	Vascular Plant	Petasites sagittatus	Arrow-leaved Sweet-coltsfoot	G5
WN	Vascular Plant	Phacelia ranunculacea	Blue Scorpion-weed	G3G4
GM, OT	Vascular Plant	Phegopteris hexagonoptera	Broad Beech Fern	G5
HO	Vascular Plant	Phlox amplifolia	Large-leaved Phlox	G3G5
MO	Vascular Plant	Phlox buckleyi	Sword-leaved Phlox	G2
HI	Vascular Plant	Pinguicula vulgaris	Common Butterwort	G5
WN	Vascular Plant	Platanthera ciliaris	Yellow-fringe Orchid	G5
HO	Vascular Plant	Platanthera clavellata	Small Green Woodland Orchid	G5
GM	Vascular Plant	Platanthera orbiculata	Large Roundleaf Orchid	G5?
WM	Vascular Plant	Poa fernaldiana	Wavy Bluegrass	G5?T3
HM	Vascular Plant	Poa paludigena	Bog Bluegrass	G3
MO, GM	Vascular Plant	Polemonium vanbruntiae	A Jacob's Ladder	G3
OT	Vascular Plant	Polygonum careyi	Carey's Smartweed	G4
HO	Vascular Plant	Polytaenia nuttallii	Prairie Parsley	G5
GM, HM	Vascular Plant	Potamogeton bicupulatus	Snail-seed Pondweed	G4?
GM, HI	Vascular Plant	Potamogeton confervoides	Algae-like Pondweed	G4
GM	Vascular Plant	Potamogeton hillii	Hill's Pondweed	G3
MO	Vascular Plant	Potamogeton tennesseensis	Tennessee Pondweed	G2
WM	Vascular Plant	Potentilla robbinsiana	Robbins' cinquefoil	G1
WM	Vascular Plant	Prenanthes boottii	Boott's Rattlesnake Root	G2
GM	Vascular Plant	Prenanthes trifoliolata	3-leaved Rattlesnake-root	G5
FL	Vascular Plant	Primula mistassinica	Bird's-eye Primrose	G5
HM	Vascular Plant	Prunus alleghaniensis var davisii	Alleghany Or Sloe Plum	G4T3Q
HM	Vascular Plant	Psilocarya (=Rhynchospora) scirpoides	Bald Rush	G4

Appendix I

HM, HI, OT	Vascular Plant	Pterospora andromedea	Giant Pinedrops	G5
HM	Vascular Plant	Pycnathemum pilosum (=verticillatum var pilosum)	Hairy Mountain Mint	G5T5
WM	Vascular Plant	Pyrola asarifolia	Pink Wintergreen	G5
GM	Vascular Plant	Pyrola chlorantha (=virens)	Greenish-flowered Wintergreen	G5
HI	Vascular Plant	Ranunculus lapponicus	Lapland Buttercup	G5
OT	Vascular Plant	Ranunculus rhomboideus	Prairie Buttercup	G4
GM	Vascular Plant	Ribes triste	Swamp Red Currant	G5
HI	Vascular Plant	Rubus acaulis	Nagoonberry	G5
HM	Vascular Plant	Rudbeckia fulgida var speciosa	Orange Coneflower	G5T4?
HM	Vascular Plant	Rudbeckia fulgida var sullivantii	Sullivant Coneflower	G5T3T4Q
HI, OT	Vascular Plant	Salix pellita	Satiny Willow	G5
GM, HM	Vascular Plant	Saxifraga paniculata (=aizoon)	Livelong Saxifrage	G5
FL	Vascular Plant	Scheuchzeria palustris	Pod Grass	G5
GM	Vascular Plant	Scheuchzeria palustris ssp americana	American Scheuchzeria	G5t5
HM	Vascular Plant	Scirpus (=Schoenoplectus) hallii	Hall's Bullrush	G2
GM	Vascular Plant	Scirpus (=Schoenoplectus) subterminalis	Water Bulrush	G4G5
HI	Vascular Plant	Scirpus (=Schoenoplectus) torreyi	Torrey's Bulrush	G5
HM	Vascular Plant	Scleria pauciflora	Fewflower Nutrush	G5
HM	Vascular Plant	Scleria triglomerata	Whip Nutrush	G5
HO	Vascular Plant	Scutellaria parvula var parvula	Small Skullcap	G4T4
HO, WN, MO	Vascular Plant	Scutellaria saxatilis	Rock Skullcap	G3
GM	Vascular Plant	Sedum rosea	Roseroot Stonecrop	G5
GM	Vascular Plant	Selaginella rupestris	Ledge Spike-moss	G5
HI	Vascular Plant	Senecio (=Packers) indecorus	Plains Ragwort	G5
WM	Vascular Plant	Silene acaulis var exscapa	Moss Campion	G5T5
MO	Vascular Plant	Silene virginica var robusta	Robust Fire Pink	G5T1Q
GM	Vascular Plant	Sisyrinchium angustifolium	Pointed Blue-eyed-grass	G5
GM, HM	Vascular Plant	Sisyrinchium atlanticum	Eastern Blue-eyed-grass	G5
HM	Vascular Plant	Sisyrinchium strictum	Blue-eyed Grass	G2Q
GM	Vascular Plant	Solidago squarrosa	Squarrose Goldenrod	G4?
GM	Vascular Plant	Sorbus decora	Northern Mountain-ash	G4G5
GM	Vascular Plant	Sparganium fluctuans	Floating Bur-reed	G5
HM, HI	Vascular Plant	Sporobolus heterolepis	Northern Dropseed	G5
HO	Vascular Plant	Stachys clingmanii	Clingman's Hedge-nettle	G2Q
HI	Vascular Plant	Stellaria longipes	Long-stalked Stitchwort	G5
HO	Vascular Plant	Stenanthium gramineum	Eastern Featherbells	G4G5
HI	Vascular Plant	Tanacetum huronense (=bipinatum var 2)	Huron Tansy	G5T4T5
HI	Vascular Plant	Thalictrum venulosum	Veined Meadowrue	G5T4?Q
OT	Vascular Plant	Tiarella cordifolia	Heart-leaved Foam-flower	G5
GM	Vascular Plant	Torreyochloa pallida (=Puccinellia fernaldi)	Pale Manna Grass	G5?
HO, MO	Vascular Plant	Trichomanes boschianum	Bristle-fern	G4
HM	Vascular Plant	Trichostema brachiatum	False Pennyroyal	G4G5
HM	Vascular Plant	Trichostema dichotomum	Forked Bluecurls	G5
MO	Vascular Plant	Trifolium virginicum	Kate's Mountain Clover	G3
MO, WM	Vascular Plant	Triphora trianthophora	Nodding Pogonia	G3G4
HM	Vascular Plant	Triplasis purpurea	Purple Sandgrass	G4G5
FL	Vascular Plant	Trollius laxus laxus	Spreading Globe Flower	G4T3
GM	Vascular Plant	Utricularia geminiscapa	Hidden-fruited Bladderwort	G4G5
GM	Vascular Plant	Utricularia resupinata	Northeastern Bladderwort	G4
GM	Vascular Plant	Uvularia perfoliata	Perfoliate Bellwort	G5
WM	Vascular Plant	Vaccinium boreale	Boreal Blueberry	G4
HI, OT	Vascular Plant	Vaccinium cespitosum	Dwarf Huckleberry	G5
GM	Vascular Plant	Vaccinium uliginosum	Alpine Blueberry	G5
MO	Vascular Plant	Viola appalachiensis	Appalachian Blue Violet	G3
OT	Vascular Plant	Viola lanceolata	Lance-leaved Violet	G5
WN	Vascular Plant	Vitis cinerea	Summer Grape	G4G5
MO	Vascular Plant	Vitis rupestris	Sand Grape	G3
HO	Vascular Plant	Vittaria appalachiana	Appalachian Vittaria	G4
HO	Vascular Plant	Waldsteinia fragarioides	Barren Strawberry	G5
GM	Vascular Plant	Woodsia glabella	Smooth Woodsia	G5
HO, MO	Vascular Plant	Woodwardia areolata	Netted Chainfern	G5
HO	Nonvascular Plant	Baeomyces absolutus		G4
HO	Nonvascular Plant	Bryoxiphium norvegicum		G5?
HI, OT	Nonvascular Plant	Cetraria (=ahtiana) aurescens	Yellow ribbon lichen	G3G5
HI, OT	Nonvascular Plant	Menegazzia terebrata	Port-hole Lichen	G4?
HI	Nonvascular Plant	Pohlia lescuriana	Spongy Gourd Moss	G4?
MO	Nonvascular Plant	Tortula ammonsiana	Ammon's Tortula	G1
OT	Nonvascular Plant	Usnea longissima		G3